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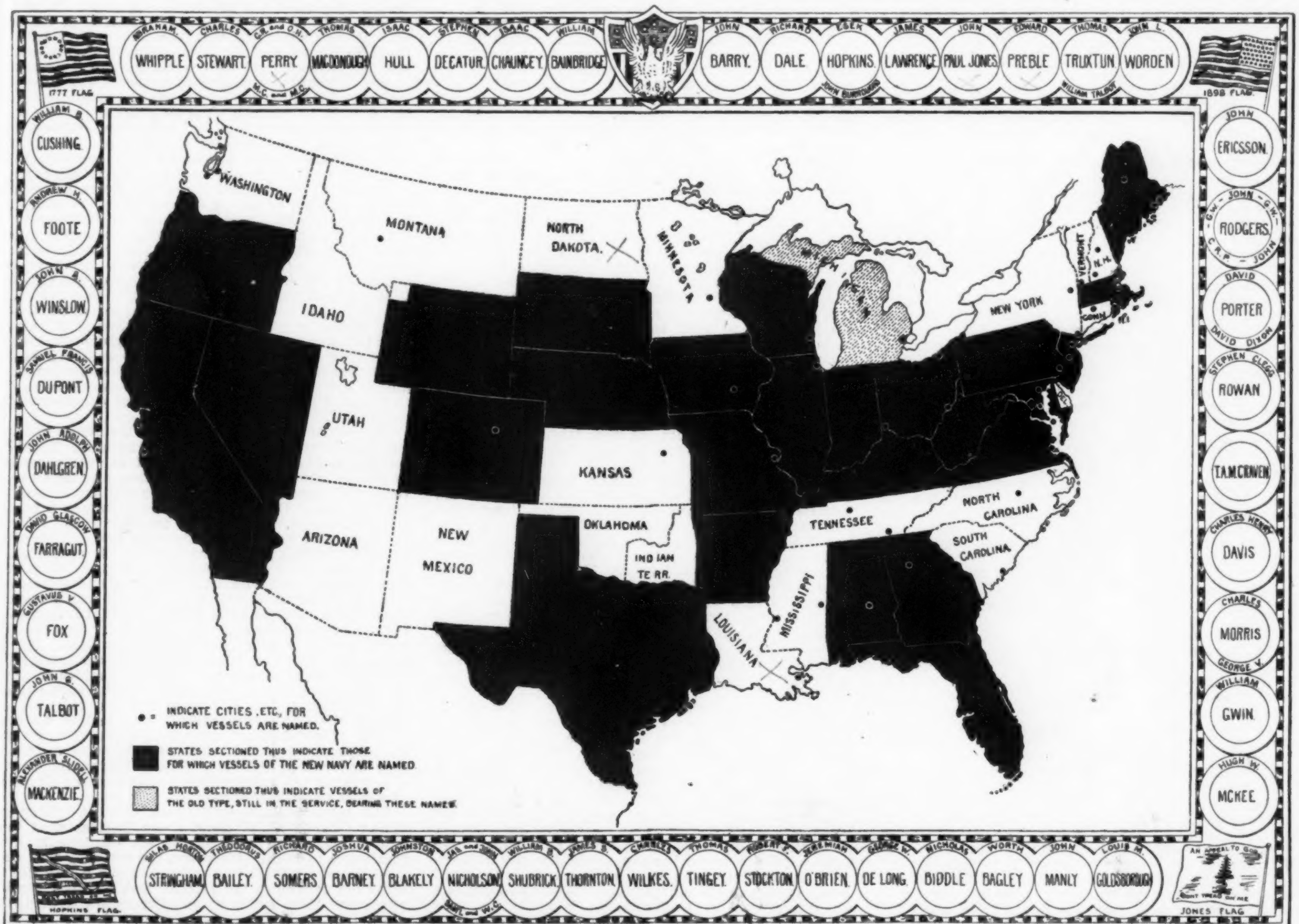
THE NAMING OF OUR WAR VESSELS.

The ceremony attending the launching of warships varies almost as the nationality, but whether it be by the sprinkling of holy water, or by the freeing of song-birds, or by the scattering of flowers, or by the time-honored American custom of causing a maiden to break a bottle of champagne on the prow, it has the same end in view, that is the christening or naming of the ship. Little is thought, by the sponsor, or by the throng that has assembled to see the great mass of metal slide from the ground into her native element, of the care and worry experienced in selecting her name, or its meaning or derivation, for they may say with Shakespeare, "What's in a name! That which we call a rose by any other name would smell as sweet;" and it is equally apparent that the efficiency of a warship is the same re- the merchantman and the yachtsman, but for the navy, the bulwark of the nation, "Jack" prefers, aye he demands, names that mean "something." This statement is quickly proven when we glance at the names of vessels which comprise the navies of the world to-day. Of course a navy is made up of warships of various sizes and types, from the torpedo boat of forty tons displacement, marking the smallest type, to those gigantic floating fortresses, weighing fifteen thousand tons and over, termed battleships; between these extremes are others called cruisers and gunboats. In the selection of names for these different types, the heaviest vessels invariably receive the most dignified or imposing names, and the others gradate in prominence of names as their types. The smaller vessels, in many instances, receive the names of birds, reptiles or animals, whose characteristics, such as beauty, fleetness, "Columbus," "Lexington," "Washington," "Liberty," "America," "Philadelphia," "New York" and "Boston," thus portraying a patriotic sentiment, a large majority of the smaller vessels, of from two to ten guns, sailed and fought in the cause of liberty and independence (and it is recorded did much toward its realization) under such odd and seemingly ridiculous names as "Anti-traitor," "Cat," "Beggars' Bimson," "Betsy and Sally," "Catch-all," "Good Luck," "Macaroni," "Irish Gimblet," "Peggy," "Peter," "Quick Lime," "Scotch-Irish," "Spitfire," "Shelally" and "Tyrannicide;" isn't that a combination? No wonder we achieved independence; between the names of the vessels and the ability and bravery of the "men behind the guns" we were invincible. The Christian name of a warship, however, is by no means a talisman insuring to her success and renown. She may be honored with the



NAMES AT TOP OF FRAME ARE THOSE OF TORPEDO BOAT DESTROYERS — NAMES AT SIDES AND BOTTOM OF FRAME ARE THOSE OF TORPEDO BOATS

MAP SHOWING STATES AND CITIES FOR WHICH VESSELS OF THE NAVY ARE NAMED.

gardless of her name; yet notwithstanding this axiomatic reasoning, careful thought and mature deliberation have characterized the selection of names for vessels of war almost from time immemorial. Even the primitive savages, whose war canoes consisted of hollowed trunks of trees, sharpened at the ends, gave to their craft names commensurate with their size and efficiency as fighting auxiliaries, and it requires but a glance into the histories of the various nations and tribes which inhabit the earth to discover that the same general practice or system has existed among all peoples, whether adjacent or remote, from the earliest floating construction up to the present time. The warrior of the sea, despite his rough and dangerous life, is inherently superstitious and romantic; to him the mysterious and supernatural appeal with greater force than to his contemporary, the landsman, or even to his brother of the merchant marine. His ideal is the wonderful prowess of some mythological deity, or the heroic achievements of his forefathers; and the romance and glory of their deeds is so much a part of his life, that his craft must bear their mark. Poetical and euphonious names may be pleasing and satisfactory to stealth, cunning or pestiferousness, their kind is supposed to typify. Thus among the many battleships of Great Britain we find such names as "Invincible," "Goliah," "Nelson," "Mars," and "Majestic;" "Deutschland," "König Wilhelm" and "Friedrich der Grosse" are among those to be found in the German imperial navy; in the French navy we see "Charlemagne," "Charles Martel," "Jean d'Arc" and "Formidable," and thus we might continue through the Russian, Italian, Spanish, Japanese and other navies with similar results. Among the smaller vessels, "Hawks," "Buzzards," "Panthers," "Scorpions," "Rattlesnakes," "Sandflies," etc., are to be found in abundance. The United States of America, like the other great nations, has also followed some such practice, which latterly has been reduced to a system. The navy of the Revolution of 1776, however, which assisted so materially in achieving our independence, was of such a nondescript character, being composed of both public and private armed vessels, that little or no system as to names could be followed. Each commander or owner selected the name which he thought best, and notwithstanding that some vessels were given such historical names as name of a deity noted for prowess, or a name brilliant on the tablets of history, and yet never add one jot to the honor or glory of her namesake. It is without doubt opportunity that makes great names, that element of chance which enters into every one's life commonly called luck. This applies as much to warships as to individuals; the opportunity seized and the glory once achieved, clings almost forever. The "Constitution" was no better vessel than the "United States;" the "Oregon" no more efficient than the "Massachusetts," neither was the "Brooklyn" more competent than the "New York," yet to one came the opportunity, the luck, while the other was passed by. A name is, therefore, what you make it. The miscellaneous craft, before mentioned, and many others of similar name and armament, comprised the navy of the United Colonies from 1775 to 1785. Few, if any, of the vessels built or purchased between these years, remained at the close of 1785. The whole of the American fleet, which had, in conjunction with the army, made the United States of America a fact, had either been captured, destroyed, sold or given away; the public treasury was too depleted by the exhaustive war just con-

cluded, and Congress too antagonistic to allow of the purchase or building of a sufficient number of vessels of war to establish even a coast guard, therefore between the years 1785 and 1797 the United States was practically without a navy, although some of the individual States did at their own expense maintain a few small armed vessels along their coast.

This condition of inaction, almost criminal negligence, on the part of Congress, was rudely disturbed by the indignation of the country on account of the perfidious conduct of the Dey of Algiers and the helpless condition of the United States owing to this lack of armed vessels. Even then, with the citizens of the republic demanding that the honor and dignity of the nation should be upheld, the lethargic patriotism of Congress was made manifest in the Act of March 27, 1794, authorizing the building of six frigates to protect the commerce of the United States, which provided that "in case of peace with Algiers no further proceeding should be held under said act." Peace was concluded before any of the vessels authorized were completed, and it is a melancholy fact that the influence of Washington and other prominent men was necessary to secure special legislation in order that these vessels, which later did such effective work, might be prevented from rotting on the stocks. These six frigates named the "Constitution," "United States," "Constellation," "President," "Congress" and "Chesapeake," may be considered as the first vessels of the United States navy. They were known as 44-gun and 36-gun frigates, their respective dimensions being as follows:

	Constitution. United States President.	Constellation. Congress. Chesapeake.
Length	175 feet	161 feet
Beam	43.6 "	40 "
Depth of hold	14.3 "	13.5 "
Maximum draft of water	23.5 "	22.5 "
Number of guns	50	38
Displacement in tons, about	1576	1268
Speed in knots	13½	12
Complement, officers crew	400	340

The term 44 and 36-gun frigate was used to denote rate, and seldom expressed the total number of guns carried.

The "United States," launched at Philadelphia, Pa., July 10, 1797, was named for that union of States that made the republic an actuality. This frigate previous to the war of 1812, owing to her dull sailing qualities, acquired the sobriquet of "Old Wagon." Cost of construction was about $299,336. The "Constitution," launched at Boston, Mass., October 21, 1797, was named in honor of that famous document, approved March 4, 1789, that guarantees to all citizens of the United States "Life, liberty, and the pursuit of happiness." This famous frigate, due to the manner in which she was handled by her several commanders, and her marked success as a warship, soon acquired the nickname of "Old Ironsides." Her cost of construction was about $302,719. The "Constellation," launched at Baltimore, Md., September 7, 1797, was named to honor "a constellation in the Western firmament," represented by the circle of thirteen white stars in the blue field of the national flag just adopted. The "President," built at New York; the "Congress," built at Portsmouth, N. H.; and the "Chesapeake," built at Norfolk, Va., were not completed until a much later date. They were named respectively for the chief magistrate of the nation, the President; the legislative branch of the national government, Congress; and for Chesapeake Bay, the largest bay on the Atlantic coast, opposite the mouth of which (at Norfolk) this vessel was built; a bay on whose borders Congress had often met (at Annapolis). But two of these six frigates remain to the United States, viz., the "Constitution," housed over, and used as a receiving ship at Boston, Mass.; and the "Constellation," rebuilt in 1854 and now used as a training ship at Newport, R. I. Of the four others, the "President" was captured by a British squadron off New York, January 15, 1815, after a running fight of six hours in which she did great damage to the enemy. She is still in existence, being used, under the same name, by the British government, as a drill ship for the Royal Naval Reserve at their West India Docks.

The "Chesapeake" was captured by the British frigate "Shannon" off Boston, June 1, 1813, after a severe engagement in which the gallant Lawrence, though mortally wounded, uttered that famous command, "Don't give up the ship." The "Congress" was broken up at Norfolk navy yard in 1836, and the "United States" was destroyed at the same yard by the Confederates, May, 1862. Four vessels have been named "Congress;" the last to bear that name was launched in 1841, and sunk in the unequal fight with the Confederate ram "Virginia," later called the "Merrimac," in Hampton Roads in 1862. From the "Constitution," however, the "lucky ship" of the six, the "Yankee-built pine box" that humbled the haughty Englishman, defeated the confident Frenchman, and crushed the scornful and defiant Turk, does the present navy concede its origin and inherit its glory. It is to be hoped that in the near future Congress will appropriate sufficient funds to remove the homely shed that now covers and disfigures this historic vessel, and enable the Navy Department to repair and respar her; place in position a battery similar to the one she carried in the days of her success, and thus, clad in her former attire, transfer her to Washington, D. C., there to stand an historic memorial at the capital of the nation she served so well.

Following the first six frigates came a number of vessels of various types, some bearing the names of such prominent men as "George Washington," "Franklin," "John Adams," and others. An interesting fact may be mentioned at this time, in connection with the building of the "John Adams;" the vessel was built by contract, and the building of one side was sublet to another party, who in the spirit of economy employed colored men to do the work, and reduced the molds to such an extent that the vessel when completed was several inches narrower on one side than on the other; this, however, did not materially interfere with the stability of the vessel, but did make her sail much better on one tack than on the other. The "Alliance," another vessel of this time, was named to commemorate the treaty of alliance between the United States and France. The "Enterprise" is a sample of one of the fanciful names given to ships of this period. No regulation for nomenclature of vessels of war of the United States existed, however, prior to March 3, 1819, when Congress passed the following resolution, which was amended in 1858 by the addition of section No. 1530:

"Section 1531. The vessels of the navy shall be named by the Secretary of the Navy, under direction of the President, according to the following rule: Sailing vessels of the first class shall be named after the States of the Union, those of the second class after the rivers, those of the third class after the principal cities and towns, and those of the fourth class as the President may direct. Steamships of the first class shall be named after the States of the Union, those of the second class after the rivers, and principal cities and towns, and those of the third class as the President may direct.

"Section 1532. Care shall be taken that not more than one vessel in the navy shall bear the same name.

"Section 1533. The Secretary of the Navy may change the name of any vessels purchased for the navy by authority of law." (This amendment was added August 5, 1861.)

"Section 1530. Steamships of forty guns or more shall be classed as first rates, those of twenty guns and under forty as second rates, and all those of less than twenty guns as third rates."

These regulations were in force at the beginning of the civil war, but after Mr. Fox was appointed Assistant Secretary of the Navy, his intense love of purely American names for vessels of the navy was allowed full play; as a consequence, many, if not a majority, of the vessels bought or built for the great struggle between the North and the South were given Indian names. The Monitor type having achieved such success, most of the vessels built at this time were either of this type or of the ironclad class, and invariably received Indian names. The "Canonicus," named for the great chief of the Narragansett tribe, and translated means "He is of tall aspect;" "Comanche," meaning "separated," the name of a tribe of Indians who formerly dwelt in the region about the State of Texas; "Wyandotte," meaning "the islanders," the name of a branch of the great Iroquoian tribe known also as the Hurons, who inhabited the northwest part of the United States about the great lakes; "Nantucket," a corruption of Spanish and Indian meaning "a seaman" or "follower of the sea," a term given to the native inhabitants of Nantucket Island by the early Spanish navigators on account of their fondness for the sea; "Oneota," "Roanoke," "Nahant," "Lehigh," "Osage," are samples of these names, whose pronunciation and romantic appearance sound and look better than their translations, their main distinction being that they are purely American names. "Dunderberg," meaning "thundering mountain," is a sample of some of those peculiar names that escape the system of nomenclature authorized, and are permitted to exist among vessels of the United States navy.

The "Monitor," that "cheesebox on a raft," that revolutionized naval architecture and made the name of Ericsson famous, was so named by her inventor, his reasons for the selection of the name "Monitor" being thus stated in a letter to Assistant Secretary of the Navy Fox in 1862: "Sir: In accordance with your request, I now submit for your approbation a name for the floating battery at Greenpoint. The impregnable and aggressive character of this structure will admonish the leaders of the Southern rebellion that the batteries on the banks of their rivers will no longer present barriers to the entrance of the Union forces. The ironclad intruder will prove a severe monitor to those leaders. But there are other leaders who will also be startled and admonished by the booming of the guns from the impregnable iron turret. 'Downing Street' will hardly view with indifference this last 'Yankee notion,' this monster. To the Lords of the Admiralty, the new craft will be a monitor, suggesting doubt as to the propriety of completing those four steelclad ships at three and one-half millions apiece. On these and many similar grounds I propose to name the new battery 'Monitor.'"

Another historic ship, still in existence, that should not be overlooked before we come to the new navy is the "Hartford," Admiral Farragut's flagship in the Gulf Squadron during the civil war. This famous vessel was launched at Boston navy-yard, November 22, 1859, at which time she received a triple christening; a bottle of Connecticut River water, one of Hartford spring water, and one of ocean water being used on that occasion. The "Hartford" has recently been rebuilt and armed with modern guns and is now doing active service. She received her name from the city of Hartford, the capital of the State of Connecticut, the word being a union of two others, "Hart"-"ford," alluding to a crossing or ford in the Connecticut River located near the present capital city, used in its days by the denizens of the forest.

(To be continued.)

SWISS MOUNTAIN RAILWAYS AND PASSES.

VILLA SERBELLONI,
BELLAGGIO, September 16, 1901.

WHEN Adolf Guyer-Zeller, the enterprising Swiss railway president, died two years and a half ago, it was commonly assumed that the railway up to the summit of the Jungfrau (13,670 feet above sea level), which he had projected and commenced building would never be completed. The last edition of Baedeker's "Switzerland" (a book which is always surprisingly up to date and omniscient) declares that his death "has made the complete realization of this bold undertaking somewhat problematical." When I arrived in the Bernese Oberland, a few weeks ago, I was therefore eager to ascertain the state of affairs at headquarters.

Before going to the Little Scheidegg, where the Jungfrau Railway begins, we spent a couple of weeks on the opposite slope, at Mürren—a proceeding which I commend to all tourists who have plenty of time, because, in my opinion, no other easily accessible place in Switzerland except Zermatt commands, from the eminences surrounding it, such glorious views of giant peaks, vast snowfields, and stupendous glaciers. The amphitheatric grouping, too, of the snowy mountains makes Mürren perhaps the best of all Swiss resorts for admiring the Alpine glow after sunset, which always causes a stampede for the door among the guests of the Hôtel des Alpes in the middle of dinner. The finest viewpoint in the neighborhood is the Schilthorn, which even women who are not experts can climb. Its summit is 9,753 feet high, and just as we reached it, an avalanche tumbled down from the snowfields of the Tschingelhorn, directly opposite, which several guides, who happened to be present, said was the grandest they had ever seen. A mass of snow and ice bigger than a cathedral fell straight down the precipitous rock, at least two thousand feet. Half way down, a ledge divided it into two falls, while a fresh supply of snow from above made the white, thundering mass continuous from top to bottom.

It was while coming down from the Schilthorn to Mürren one day in August, 1893, that Guyer-Zeller conceived the plan for the Jungfrau Railroad that is at present being carried out. Before him lay the giant group consisting of the Eiger, Mönch, and Jungfrau, and far below them, looking like a child's toy, was the Wengernalp Railway, taking tourists up to the Scheidegg. "Why not begin the Jungfrau Railway at the Scheidegg instead of in the Lauterbrunnen or Grindelwald valley?" he said to himself. "That would give us a start and a saving of 3,500 to 4,000 feet." The arrangements were made in accordance with this plan, and in September, 1898, the first section of the road was ready for use. To-day the Swiss time-tables have a section headed "Jungfrau-Bahn"—nine trains a day from Scheidegg to Eiger Glacier in sixteen minutes, and thence, in eight minutes more, to the second station, Rothstock, at an altitude of 8,270 feet. This, to be sure, leaves 5,400 feet still to be ascended; but the technical difficulties have all been triumphantly overcome, and the sole question now to be solved is of a financial nature. Will this railway, if sufficient money for its completion can be raised, ever pay?

This question was, of course, considered at the outset. It was estimated that the total cost would be about $2,000,000, and the gross annual receipts nearly $150,000, which would leave a fair margin for a profit. It was natural to suppose that Guyer-Zeller's sanguine nature had led him to overestimate the future receipts; but present indications seem to point the other way. We did not ourselves patronize the new railway, but walked from the Scheidegg to the Eiger Glacier and back; the trains that passed us were crowded. The cost of the round trip from Scheidegg to the present terminus is just a dollar. I see in a Berne newspaper that the number of passengers carried by the Wengernalp Railway, which feeds the Jungfrau Railway from the Lauterbrunnen Valley, was 43,835 during the single month of August—a gain of 3,395 over August, 1900. The cost of a second-class round-trip ticket to the Scheidegg (including ascent or descent on the Grindelwald side) is nearly $5; and it stands to reason that a large proportion of those who go as far as the Scheidegg would be glad to pay the additional $7, which would take them to the top of the Jungfrau—commanding a view of unspeakable grandeur—and back again. At present the cost of the ascent of this mountain, with guides and a porter, is $20 to $40 for each person, not to speak of the toil—to which few are equal—and the danger to life or limb.

Fredrich Wrubel, the inspector of the Jungfrau Railway, has written a ninety-two page brochure, "Ein Winter in der Gletscherwelt," which, I am not surprised to find, is already in its third edition. As its title intimates, it describes some of the novel experiences of the builders of the Jungfrau Railway during a winter spent at the entrance to the tunnel, by the side of the huge and magnificent Eiger glacier. Up to that time this famous glacier had been merely ornamental; it was now made useful, too, for the time being. As all communication with Lauterbrunnen and Interlaken was cut off during the winter storms, it was necessary to put the perishable parts of the supply of food needed for eighty men into cold storage, and for this the crevasses of the glacier seemed just the place. It was found, however, that the meat thus stored spoiled too soon after being thawed out, so it was decided to bring up live cattle, swine, and sheep, for the next winter. As to water, the glacier remained the only source, besides the fresh snow, which was melted by electricity, of which there was enough and to spare for all purposes. Electricity lighted and heated the buildings and cooked the food, besides boring the tunnel and moving the construction-cars—all at an elevation of a mile and a half above sea.

The laborers were well taken care of. They received from 86 to 94 cents a day, besides good food and lodging, each man having six blankets to keep him warm at night. Moreover, the company took care of those who fell ill, and gave each one a free life or disability insurance for $1,200. But, as Herr Wrubel remarks: "The better some laborers are treated, the more they demand." There was a strike; the men asking, among other things, for their full wages on Sundays and holidays because they were not *allowed* to work! This was too much for the directors, and they paid off twenty of the most obstreperous men. These realized their folly at once, and endeavored repeatedly to get back; but the directors decided to make an example of them, and their places were at once filled. A pathetic account is also given of the only serious accident that occurred, six men, owing to non-observance of the rules regarding the use of dynamite, being blown to fragments in the tunnel. The funeral procession, amid these wintry Alpine surroundings, must have been as impressive a scene, even without music, as Siegfried's death in Wagner's opera. Herr Wrubel also describes the æsthetic aspects of the scenery, and what he says on this head is tantalizing and somewhat exasperating to us summer tourists; for he tells us that in winter the mountains are clearer and look higher and more shapely than in summer, the sunsets and the Alpine glow are more thrilling, the moon and starlight effects incomparable, and the storms tremendously exciting and delightful to those who love Nature in her wildest moods. Of scientific interest are the remarks on pp. 26, 27, where the author describes the changing colors of the glacier, which were found to be more reliable weather prophets than the costliest barometers.

The Jungfrau tunnel has now reached an altitude of about 9,100 feet above sea-level, and will, therefore, soon attain the level of the Gornergrat Railroad at Zermatt (10,290), which is at present the highest railway in Europe. The chief engineer, M. Gobat, declares that the highest and most difficult section of the Jungfrau Railway will, if completed, hardly pay for itself; but in any case, he says, the tunnel will have to be carried up to the Jungfraujoch, 11,090 feet above sea. Here the passengers will step from the cars right on to the seemingly illimitable dazzling snowfields, whence it is a climb of only 2,580 feet to the summit. The superb view from the Jungfraujoch will in itself repay the trip; but the projectors of the road have planned a bold scheme, which will fascinate tourists by its striking novelty as well as its intrinsic attractiveness. As soon as the trains run up to this station it will be possible to cross over from the Bernese Oberland to the Valais region, not by means of a mountain railway on the other side, but on sleighs speeding across the moderate and smooth slopes of the huge Aletsch glacier, which is only ten kilometers from Brig, where the Simplon tunnel begins, and whence also Zermatt and the Matterhorn can be reached in a few hours more by rail.

Switzerland has long felt the need of a short and direct road connecting, as will the one just described, the Oberland and the Valais, especially for the benefit of tourists (and the republic lives on tourists) whose time is limited. When one looks at the map, the détours one has to make at present seem comic. As the bee flies, it is only about twenty miles from Mürren to Brig, in the Rhone valley, but on account of the intervening mountain giants one needs two days or more, by carriage or on foot, to go from one of those points to the other by way of the Grimsel or Gemmi pass, or a very long day by rail via Berne and Lausanne—which is like going from New York to Tarrytown by way of Boston and Albany. About ten years ago a railway was planned to run from Spiez, near Interlaken, to the Rhone Valley in the Valais, and a small section of road, commanding splendid views of the Blümlisalp and other snow-peaks was opened this summer as far as Frutigen; but the remainder calls for so long and expensive a tunnel that it will probably not be completed for another decade if ever.

Personally, I do not care if this railway—or any railway that depends for its existence on a long tunnel—is ever built. I prefer to walk over the tunnels, as high as possible, for mountain passes seem to me the most interesting of all points of view. As seen from the valleys, the peaks are, of course, higher; but, being less near, they are not so imposing. From the peaks one can look down only, but from the passes one looks up, too, at the snowy summits, which are the crowning glory of all. The desolate and forbidding aspect of the passes in their highest stretches affects a true mountain-lover like a grand tragedy; and when he has enjoyed this to the full, a delight of a different sort awaits him in the descent, on the other side, into the smiling green valleys. We specially planned our trip this year so as to take in as many passes as possible, and to enjoy twice the sudden passage from the Swiss snowfields to the luxuriant chestnuts, figs, and vineyards of Italy. From Munich we went to Thusis, via Lindau and Chur; then up the Splügen pass and down on the San Bernardino side—where the quaint Italian villages clinging to the steep mountain slopes add much to the interest of the scene—as far as Bellinzona. Thence back to Switzerland and—by way of exception, to gain time—ignominiously through the St. Gothard tunnel, which, by the way, is not so well ventilated as it used to be.

At Goeschenen we left the train and walked to the top of the Furka pass, where, after a day of rain, we enjoyed the sunrise on the snowfields of the well-named Finsteraarhorn and the Schreckhorn—two of the Bernese peaks which it is difficult to see elsewhere to such advantage. From the Furka down to the Rhone Glacier, and up again across the Grimsel pass, was a day's tramp, fatiguing but glorious, as we had never before been favored with such perfect weather in this region. On leaving the Oberland we took the Gemmi pass on the way to the Matterhorn, and, after spending ten days at the Riffelalp and the Schwarzsee, we went to Brig and across the Simplon pass down again into Italy and to the Villa Serbelloni, the finest point on the Italian lakes. I give this itinerary because, after spending half a dozen summers in Switzerland, it is the one I should specially commend to friends intending to visit that country. It does not include the Engadine, Lucerne, and the Mont Blanc region; but these can be readily embraced in the plan I have given without changing it essentially. I must once more express my surprise and indignation at the American tourists, the vast majority of whom waste their time at such fashionable resorts as St. Moritz, Lucerne, Interlaken, and Geneva, and then fancy they have seen Switzerland. The English know much better where to go, and the Germans and French have gradually learned from them the best places to stay at. Unfortunately, the English have also inconsistently attempted to introduce at the high Alpine resorts the vulgar absurdity of full dress at dinner; but luckily, in that respect, the Continental tourists do not follow their example. I wonder if Englishmen take their evening dress along when they go on hunting trips or to explore Central Africa?

The Simplon is rather too long a pass to walk, so we took the diligence. I cannot agree with Baedeker that the Simplon is pre-eminent among Alpine passes in point of scenery. I prefer the Furka and the Splügen-Bernardino. But the Simplon is magnificent, no doubt, and it is sad to think that it will become practically a thing of the past, so far as tourists are concerned, when the Simplon Railway is completed, which will be in 1904, or, at the latest, 1905. It was interesting to see the men—miles of them—at work on the Italian side. At Iselle, the southern entrance to the tunnel (which will be 12½ miles long, or 3¼ miles longer than the St. Gothard), a mushroom town has sprung up, with hundreds of wooden houses, mostly hotels, restaurants, beer and wine taverns, clothing, fruit and provision stores, looking a good deal like a Western American mining town, though with plenty of Italian local color roughly splashed on.

The Simplon, to be sure, is not a real mountain railway, as it dodges all difficulties by creeping through a tunnel. Of genuine mountain railroads—the kind that climb steep slopes—there are now in Switzerland no fewer than twenty-three, and several others are projected. The names of those now in operation are Vitznau-Rigi, Arth-Rigi (there is a demand for a third one up the Rigi!), Uetliberg, Rorschach-Heiden, Lausanne-Ouchy, Bürgenstock, Pilatus, Beatenberg, Salvatore, Berner-Oberland, Lauterbrunnen-Mürren (the lower part of which will also be changed to electricity next year), Schynige Platte, Visp-Zermatt, Gornergrat, Brienz-Rothorn, Rheineck-Walzenhausen, Wengernalp, Stanserhorn, Dolder, Jungfraubahn, Stanstad-Engelberg, Reichenbach, Lausanne-Signal. I see that the Polygraphic Institute at Zürich has just issued a book on these twenty-three railways, with technical information as well as scenic descriptions, and 329 illustrations.

They must be doing a brisk business, these mountain railways, or there would not be so many of them. In their rapid multiplication, I see one of the most characteristic distinctions between Switzerland and Norway. We visited Norway in July under the impression that it was a mountainous country. So it is, no doubt; there are thousands of mountains, but there are no arrangements for stopping on them, the hotels being, with very few exceptions, built at sea level, along the fjords. I met other tourists, who, like ourselves, hunted eagerly for mountain hotels, but could not find any. The Swiss are wiser. They build their hotels where they are wanted, up the mountains, at elevations of from 2,000 to 10,000 feet above the sea, where the air is most bracing and the scenery most imposing; and they build mountain railways to make them comfortably accessible. There are, to be sure, individuals who growl that these railways and hotels spoil the Alps; but that is arrant nonsense. They make them accessible to thousands, where formerly only a few dozen robust persons could enjoy them; and as for solitude, there is not a Swiss mountain hotel whence one cannot, by ten minutes' walk, get to spots where all sound and sight of man vanishes, and one can be alone with Nature in her sublimest moods.—Henry T. Finck, in The Nation.

BRITISH OFFICE TELEPHONES.

WHEN the British Post Office decided to construct a telephone system of its own within the city of London, it was generally conceded that the government would become a serious rival to the National Telephone Company of Great Britain, a private company holding the monopoly of telephonic communication throughout the country. The government installation is now completed and will shortly be ready for service. In view of this fact the Postmaster-General has issued the tariff for the use of the service and it is divided into four classes as follows:

1. ORDINARY MESSAGE RATE.—Annual installation charge within the county of London, $25; annual installation charge outside the county, $20; for each call (in the London telephone area) outside the county of London, 4 cents; minimum yearly amount for message fees, $7.50.

2. PARTY LINE MESSAGE RATE.—Annual installation charge for connection with an exchange (except the central exchange) by means of a line used by not more than two subscribers, $15; same for connection by means of a line used by more than two and not more than ten, $10; message fees will be same for party line subscribers, but the minimum yearly amount will for each party line subscriber, $15.

3. UNLIMITED SERVICE.—Annual payment for the first line, $85; annual payment for each additional line, $70.

4. CALL OFFICE FEES.—4 cents.

The publication of these rates has caused considerable dissatisfaction. When the government embarked upon its scheme cheaper facilities were expected, but as a matter of fact the service is approximately 70 per cent dearer. Hitherto the National Telephone Company have charged $50 per annum for unlimited use, which was considered a prohibitive figure, and the Post Office is charging $85 for the same service. Moreover, the Post Office, far from competing with the private company, has secured an arrangement whereby the latter will increase their rate from $50 to $85 for the unlimited use per annum. Competition will exist between the rival systems, but it is to be of an amicable nature. The two systems will practically work together, with free intercommunication between the subscribers of both systems. That is to say, if a subscriber upon the National system desires to communicate with a person of the Post Office system, he will be switched through without any delay and extra charge. If any bitter competition were to exist between the two concerns, chaos would result. Such an event would necessitate each subscriber having the two systems installed, while the Post Office service would be limited only to London. By the present arrangement it will be possible to call up anyone expeditiously in any part of the United Kingdom.

According to the first clause in the tariff, residents within the county of London (that is the area governed by the County Council) can have an installation with an exchange, not more than two miles distant, for an annual rent charge of $25. In addition the subscriber must pay 2 cents for every message to a receiver within the county, and 4 cents per message going outside the county, with an annual minimum for the messages of $7.50. If the subscriber resides beyond the bounds of the county the annual rent is $20, the reason given for this lower tariff being that the expense of making installation is less in the more distant suburbs. By this it will be realized that the lowest cost at which a London resident can have a telephone installed is $32.50. If two subscribers use the same line, the annual installation charge is $15, and if more than two, but not more than ten, then the annual charge is to be $10, with a minimum annual rate for messages of $15.

In addition to the foregoing rates there are the extra charges for the use of the trunk lines outside of the city of London. These fees are adjusted upon the scale of 6 cents per 25 miles or less for a three minutes' conversation from the central exchange.

In comparison with the cost of the telephone service of other countries in Europe, the London service is rather expensive, as the following figures prove: Switzerland (with limitation to 400 calls per annum), $23.25; Germany, $37.50; Austria, from $40 to $70; Sweden—Government, $22; Private Company, $27.75; Hungary, $60; France, $80; Italy, from $33.75 to $45; Belgium, $50. The Post Office anticipates, however, deriving the major portion of its income from the "message rate" system. The increase of the National Company's tariff from $50 to $85 per annum for unlimited use will create widespread confusion, since the majority of their subscribers have entered into contracts for a certain number of years. Also, the Post Office holds out no special inducements to subscibers, and as the National Telephone Company has the monopoly of the trade in the city, it is impossible to understand the necessity of the government service.

SUMMARY OF THE REPORT OF M. COREAU ON THE ALCOHOL MOTOR.*

IN behalf of the Engineering Section, I will present the results of experiments and the considerations which favor the employment of alcohol in motors.

We are concerned with explosion motors, and the noise heard from all parts of our headquarters emphasizes the fact.

Gas motors and explosion motors are practically convertible terms. They all make use of a combination similar to the old standard mixture of gas and air, about one volume of the former and eight of the latter, long known from its disastrous effects. The explosions are now better regulated and raise the piston from the depth of the cylinder with more uniformity than of old.

But petroleum superseded lighting gas for automobile use. Under heat, this product gives forth vapors which form with air an explosive mixture.

Certain petroleums, by distillation and refining, yield gasoline of a density varying from 680 to 700, while the density of petroleum is set down in round figures as 800 to 820.

Gasoline projected in the air in spray forms a mixture, detonating by the contact of an electric spark or of an incandescent burner. At least 6,000 different vehicles are now supplied with this source of power.

Can alcohol, produced in France, replace wholly or in part this gasoline extracted from imported petroleum? Is the substitution possible both from a mechanical and an economical standpoint? Such is the question for the solution of which our president has requested a report from the Engineering Section.

Though for a year this question has occupied the attention of the public and of the government, it must be acknowledged that researches have not been very much encouraged.

The quantity of heat disengaged by the combustion of one kilogramme of gasoline is 11,300 units (calories), while it is only 6,500 units for one kilogramme of denatured alcohol. This difference is undeniable, but, by the mixture of alcohol with carbureting agents, with materials having, like benzine, for example, great caloric strength, this difference can be singularly diminished.

The reduction of duties on denatured alcohol favors its adoption. Its price per liter has declined since 1897 from a franc to half that figure.

Experiments have been made on a Gobron-Brillé motor, which was placed by M. Gobron at the disposal of the society.

The combustibles employed have been successively denatured alcohol (normal type), the special automobile gasoline of 680 density, and a carbureted alcohol (electrine) analyzed at the Laboratory of our Society by M. Aubin, who has verified the composition of the mixture as denatured alcohol 51.5 and benzine 45.5 per cent.

Working with full charge, the results run thus:

	Den'red alcohol.	Carb. alcohol.	Gasoline.
Horse power...	7.33	7.67	7.32
Expenditure per horse power..	0.835	0.735	0.677

The following is a comparison of the expenditure:

	Carb. alcohol.	Gasoline.
Consumption per horse power	0.735 lit.	0.677 lit.
Outside Paris, price per liter	0.45 fr.	0.50 fr.
Outside Paris, cost per horse power...........	0.330 fr.	0.338 fr.
In Paris, price per liter..	0.55 fr.	0.70 fr.
In Paris, cost per horse power	0.404 fr.	0.473 fr.

It is with the same motor, changing only the combustible liquid in the feeding reservoir, that all our experiments have been made.

The practical conditions, indicated by our president, have thus been met, corresponding to the necessities of the present epoch of transition.

The carbureted alcohol cannot yet be procured at all points, but the chauffeur need not be inconvenienced, for it can be replaced with gasoline, outside of Paris at the same expense, in Paris with a saving of seven centimes per horse power. Improvements will reduce the *pro rata* consumption of alcohol, and the cost price will decline from the diminished expense of the denaturation of alcohol, caused by the lowering of the government duties.

Before the entrance to our headquarters are two automobiles, one working with gasoline, the other with alcohol. You can compare and judge for yourselves.

More than one of us, having fled precipitately on the approach of the gasoline carriage, has turned toward the alcohol motor and been fascinated with the acceptable perfume. The chauffeur, riding rapidly, is scarcely conscious of the odors he dispenses so freely, but there are other advantages that he can appreciate. With alcohol, the movement is more gentle, the explosions less violent, and the sensation in slowing down more agreeable. Experiments have confirmed these conclusions.

The thermic yield of alcohol is superior to that of

* Translated from the Bulletin de la Société des Agriculteurs de France.

gasoline; a larger percentage of the calories is saved for effective work.

The alcohol question we may consider as solved both from a mechanical and an economical standpoint.

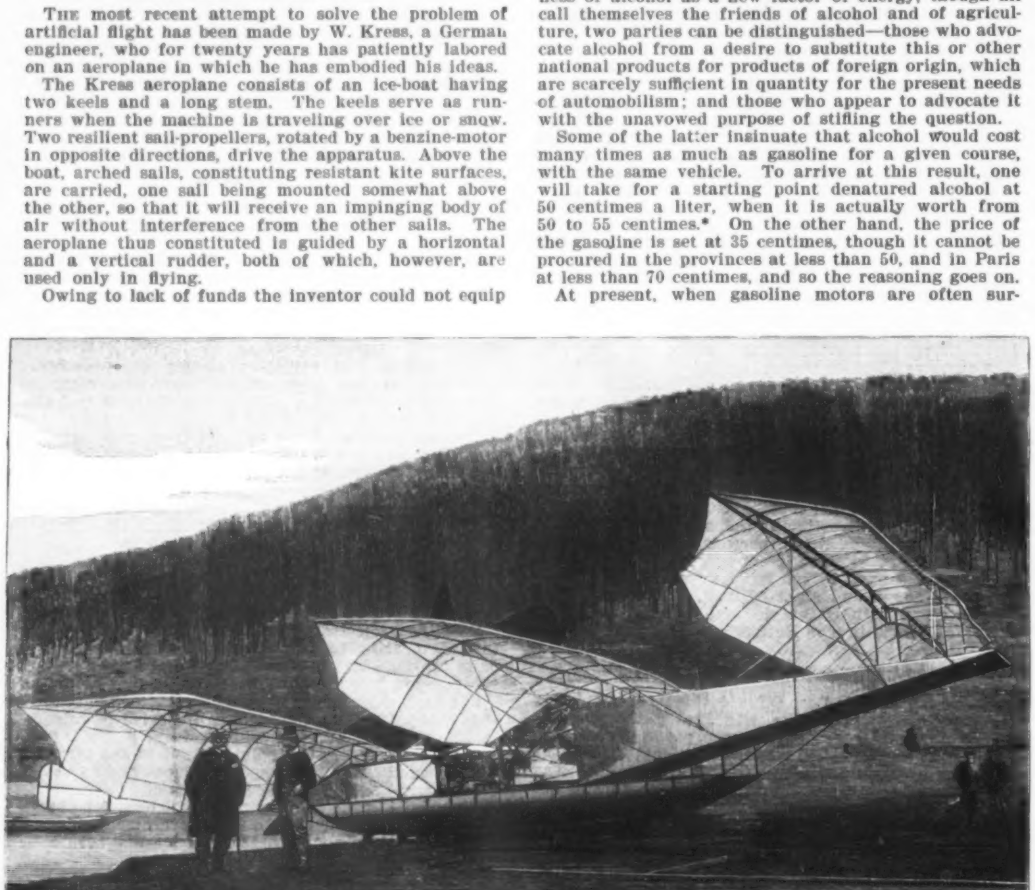
THE KRESS AEROPLANE.

The most recent attempt to solve the problem of artificial flight has been made by W. Kress, a German engineer, who for twenty years has patiently labored on an aeroplane in which he has embodied his ideas.

The Kress aeroplane consists of an ice-boat having two keels and a long stem. The keels serve as runners when the machine is traveling over ice or snow. Two resilient sail-propellers, rotated by a benzine-motor in opposite directions, drive the apparatus. Above the boat, arched sails, constituting resistant kite surfaces, are carried, one sail being mounted somewhat above the other, so that it will receive an impinging body of air without interference from the other sails. The aeroplane thus constituted is guided by a horizontal and a vertical rudder, both of which, however, are used only in flying.

Owing to lack of funds the inventor could not equip his airship with a benzine-motor of the special construction and power desired, and was therefore compelled to use an ordinary automobile-motor. Thus fitted out the aeroplane was first tried on water. For it is Mr. Kress' opinion that water-trials should first be made in order to ascertain whether the motor, propellers, rudders, and other parts have been properly arranged and are trustworthy and perfectly efficient in operation. Only when the safety of the machine has thus been proven should aerial flights be taken. The sense of security obtained by numerous water-trials and the increased speed attained with each trial will finally give to the aeronaut that confidence which will enable him to soar aloft. That moment, according to Mr. Kress, may come unawares; the ship may of its own accord leave the surface of the water.

So far as the preliminary water-trials are concerned, the Kress aeroplane seems to have met its inventor's expectations. In the presence of an officer of the aeronautical division of the German army the flying machine was taken from its housing and carted to a nearby lake. Kress seated himself in the boat and pulled the starting lever. The propellers drove the machine along at a uniform speed, according to the accounts which have been received. In order to test the maneuvering power of the contrivance Kress is said to have performed various evolutions and to have succeeded even in making headway against the wind. The steering apparatus seems to have acted efficiently. The motor, however, proved inadequate. With a motor of less weight and greater horse power the inventor believes that his flying machine would be an assured success. Lack of funds may prevent him from carrying out his plan with an improved motor.



THE KRESS AEROPLANE.

ALCOHOL AND BENZINE FOR AUTOMOBILE USE.

Among those who discuss the strength and the weakness of alcohol as a new factor of energy, though all call themselves the friends of alcohol and of agriculture, two parties can be distinguished—those who advocate alcohol from a desire to substitute this or other national products for products of foreign origin, which are scarcely sufficient in quantity for the present needs of automobilism; and those who appear to advocate it with the unavowed purpose of stifling the question.

Some of the latter insinuate that alcohol would cost many times as much as gasoline for a given course, with the same vehicle. To arrive at this result, one will take for a starting point denatured alcohol at 50 centimes a liter, when it is actually worth from 50 to 55 centimes.* On the other hand, the price of the gasoline is set at 35 centimes, though it cannot be procured in the provinces at less than 50, and in Paris at less than 70 centimes, and so the reasoning goes on.

At present, when gasoline motors are often surfeited with alcohol, with little or no intelligence, it has been found that alcohol even at 50 centimes a liter would be dearer, because a volume 20 to 25 per cent greater is necessary, according to the meter, than of gasoline. Therefore a product has been sought for among the French carbureting agents, which, added to alcohol, will diminish the price and necessary volume. Benzine has been found to fill the conditions.

By additions varying from 25 to 50 per cent of benzine to alcohol, according to the motors, these have been made to work without noticeable change, and with the same yield, volume for volume of liquid, as when gasoline or carbureted alcohol is used. This has been controverted by ignorant persons, who have made calculations based on the use of crude benzine.

Pure benzine, or benzine nearly pure, boiling between 80 deg. and 90 deg., is less dear than crude benzine, for the simple reason that it is a product of the rectification of the latter, after toluene, xylene, etc., have been extracted. The value of these will amount from 80 to 100 francs a hectoliter, while rectified benzine is worth from 25 to 35 francs, according to the state of the market.

Such is the fact relative to benzine. This cheap hydrocarbon might seem indicated as a substitute alone for gasoline. But, as soon as there is a little too much benzine, or the least lack of air, the benzine is decomposed so easily, leaving a deposit of carbon, that its use has been abandoned, especially because the explosions are more detonating. But in the proportions indicated above, the mixture is an excellent substitute for gasoline.

This is not all. It has been stated that alcohol alone or carbureted with benzine would attack the metal.

When this occurs, the *carbureter of the motor is insufficient to accomplish its purpose.* Alcohol in burning does not produce acetic acid, as some would make out, but it contains traces in the form of acetic ether, which are consumed precisely like alcohol if the agitation is complete. This cannot be effected unless the gasification of the liquid is perfect before admission in the cylinder. We must not forget that all these motors are merely gas motors, and volatilization in the cylinder of any liquid is the proof of defective working.

Under these conditions the conclusion to be drawn is that the motor, attacked by alcohol, is defective, even for gasoline, either in its carbureter or its organs of distribution or aspiration of the liquid and air. The remedy is to use good carbureters.

The only demand to make on the authorities is the lowering from 10 liters to 1 liter of the quantity of methylene allowed for adulteration, since it is known that this quantity is sufficient. The report of M. Sorel, of the commission on denatured alcohol, to the Minister of Agriculture is its proof.

For further evidence of the value of the alcohol mixture, we must wait for the third alcohol test and the motor races which will take place next year, the constructors having till then the time to make improvements in motors or carbureters.—From the French of G. Arachequesne, Engineer, in Le Chauffeur.

* Denatured or methylated alcohol, on which a reduced impost is allowed.—Trans.

POSTAL AUUTOMOBILES IN GERMANY.

Those who keep themselves *au courant* of the automobile movement throughout the world have been led to notice the attention that the postal authorities in many countries are giving to this new method of transportation. It may be hoped that the employment of the automobile will yield results much more favorable than those gained by horse traction, and we have observed that the American postal service has begun to employ mechanical vehicles for this purpose.

We have at hand an interesting report of an experiment which has been pursued in Germany for eleven months. In reality, the director of the Berlin stations has kept on trial during this long period an electric vehicle capable of carrying a load of 450 to 900 kilogrammes. It is not for the distribution of letters, but for that of printed matter, whose annual movement represents an enormous weight. The vehicle is furnished with two motors, making 600 revolutions per minute. Five advance speeds are provided for and a single one backward, which is sufficient. Two positions are allowed for the brake. The wheels are fitted with iron tires, replaced by rubber during the period of snow.

The following table will enable our readers to draw their own conclusions:

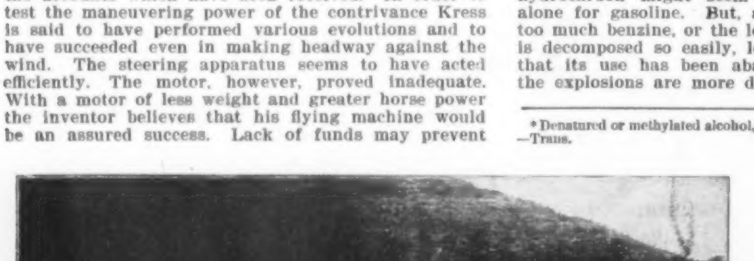
Months.	Kilometers.	Consumption. Watt Hours.
December	803	221.760
January	929	370.040
February	876	359.480
March	997	352.880
April	973	302.500
May	729	247.720
June	694	284.790

A calculation can easily be made of the cost of the kilometer with respect to the consumption of energy, allowing a definite price for électricity.

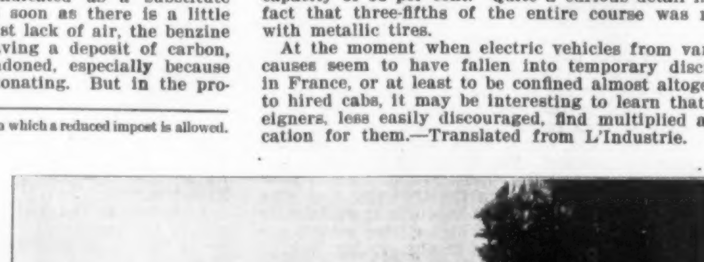
As the estimate of the weight of the vehicle, and especially of the useful weight transported, is one of the principal elements for calculation, it may be said that the vehicle itself weighs 2,268 kilogrammes and normally carries on an average a load of 725 kilogrammes. From this can be deduced the energy consumed by the weight of one ton transported per kilometer.

The original battery was used for the whole time, except during a period of cleaning, when recourse was had to a reserve battery for a time, corresponding to about 420 kilometers. When the battery was cleaned it was ascertained that it had undergone a loss of capacity of 12 per cent. Quite a curious detail is the fact that three-fifths of the entire course was made with metallic tires.

At the moment when electric vehicles from various causes seem to have fallen into temporary discredit in France, or at least to be confined almost altogether to hired cabs, it may be interesting to learn that foreigners, less easily discouraged, find multiplied application for them.—Translated from L'Industrie.



THE START OF THE AEROPLANE.



THE KRESS AEROPLANE SAILING ON WATER.

THE NEW LIGHT PANHARD-LEVASSOR AUTOMOBILE.

THE latest production of the Panhard-Levassor Company is not a reduction of the classic type which has made this firm so noted, and which has been such an inspiration to the automobile industry. It has the chief lines of the racers, but these are sufficiently modified to give it a metallic personality of its own—a personality of which we are about to present the analysis and even the anatomy. We shall see, upon dissecting it, that the building of a light-weight machine has necessitated the constructors making it simple.

The new carriage weighs, ready to run, 1,432 pounds, while the heavy machines weigh between 1,980 and 2,650 pounds. It is built in two sizes, which have nominal 5 and 7 horse power motors respectively. These motors will, however, contrary to most American motors, develop considerably more power than is claimed for them, and are said to run as high as 7 and 9¼ horse power. The vehicles are capable of making 21 and 31 miles per hour respectively, on a level road, when carrying four people.

The parts of the two models are often identical. Thus the pneumatic tires are 2½ x 29½ inch on the front wheels and 3½ x 34¼ inch on the rear. The dimensions of the frames of the two models are the same, viz., 31½ inches wide by 5 feet 9 inches in length; while the operating levers, the steering and brake mechanism, the pump, chains, etc., are necessarily interchangeable from one model to another.

But the chief parts of the principal mechanism, although appearing on a plan view identical, are evidently not the same, since they have to support quite different strains. It would not be possible, therefore, to substitute a 7 horse power motor for a 5.

The chief characteristic of the light Panhard machine, which altogether distinguishes it from the usual type, is in the speed change mechanism, which is mounted on the frame in a different manner than usual, and which has but three speeds ahead instead of four, all of which, together with the one reverse, are operated by a single lever, instead of by two.

The two plan views of the frame which we show were made from photographs of its upper and lower sides and will be found to give a good idea of the various parts of the mechanism. The frame is shown with body and bonnet removed, and without the water cooling coil and gasoline tank.

The motor is situated in front as usual and is designated by the letter *A*. It is a vertical double cylinder engine having balanced pistons which move up and down together, (one receiving an impulse one revolution and the other the next) and which draw in their charge from a common carbureter, *C*, constructed on the well-known atomizing principle and conveniently situated so as to be readily accessible.

Air is admitted to the carbureter at the bottom through the pipe *D*, which draws warm air from over the exhaust pipes of the motor. Just below the letter *D* in the diagram, Fig. 3, is a slide in this pipe through which cold air may be admitted, the latter being used in summer, while in winter the temperature of the warm air can be varied by this slide. On top of the

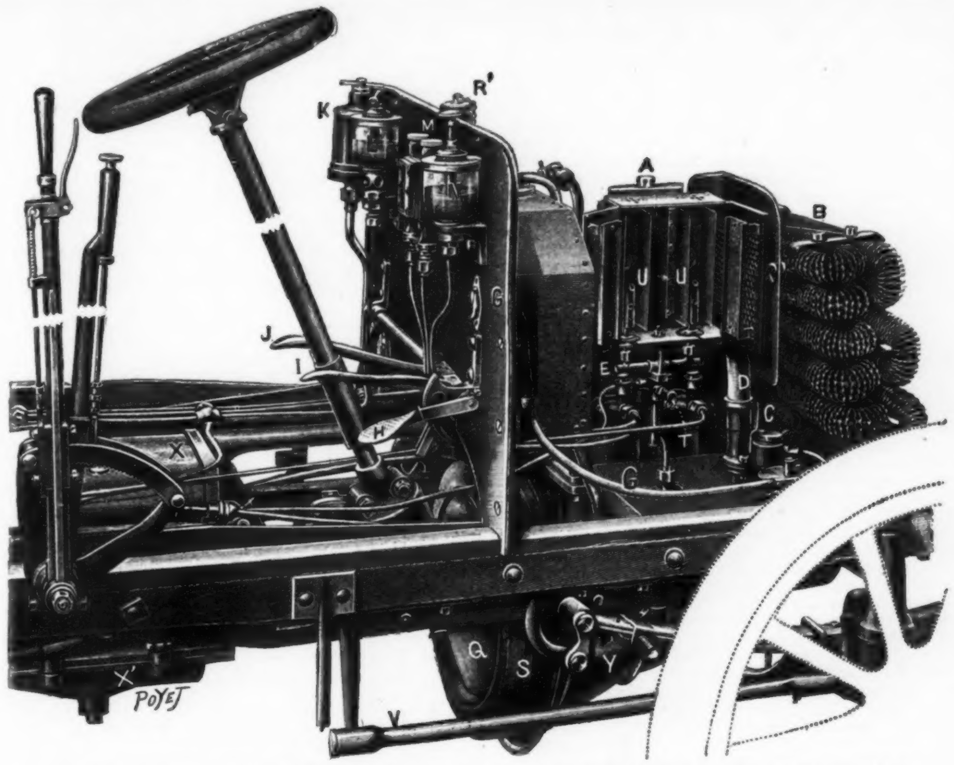


FIG. 3.—MOTOR AND MECHANISM OF LIGHT PANHARD-LEVASSOR AUTOMOBILE.

A, Top of inlet pipe; B, Radiating coils; C, Carbureter; D, Air inlet pipe from above the exhaust pipe to bottom of carbureter; E, Piping of burners; G G, Cold air pipe to carbureter for getting the mixture; H, Speeding pedal; I, Brake pedal; J, Pedal for throwing motor out of gear; T, Needle valve of the Burners. For references of the remaining letters see Figs. 1 and 2.

carbureter *C*, is another slide which covers a small hole, through which air is admitted to get the right mixture. This is obtained as nearly as possible before the carriage is started on the road, after which a finer adjustment can be obtained by moving a slide in the dashboard that covers the opening of the pipe, *G*, which also supplies air to the carbureter to form the explosive mixture.

Tube ignition is regularly employed, though this may be replaced by or have appended to it electric ignition, if complete security is desired. In America the electric ignition is regularly used, and the hot tube reserved for emergencies. The spark plugs are situated in the exhaust chamber just over the exhaust valves.

The exhaust of the two cylinders escapes through separate exhaust pipes, instead of through a common one, as formerly. The main feature of each cylinder is its separate exhaust, which makes it entirely free from any troubles from the exhaust of its mate. By this arrangement the motor gains power.

The motor is cooled by 5¼ gallons of water that is kept in circulation by a centrifugal pump driven by friction against the flywheel of the motor. The radiating coils, *B*, placed in front of the bonnet, lower the temperature of the water after it passes through the water jackets of the motor.

The normal speed of the motor is 700 revolutions per minute. The same pedal, *H*, that is found in the larger vehicles, is capable of raising this to 1,000 or 1,200 or reducing it to about 300 revolutions per minute

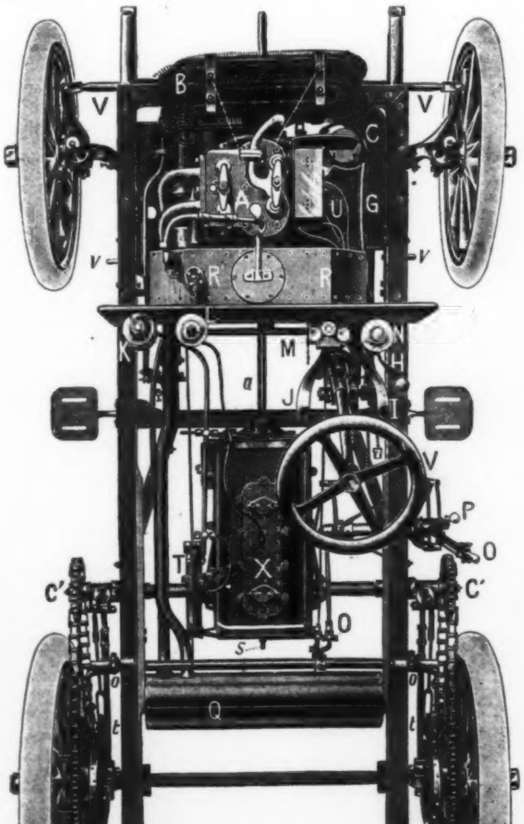


FIG. 1.—TOP OF FRAME OF LIGHT PANHARD-LEVASSOR AUTOMOBILE.

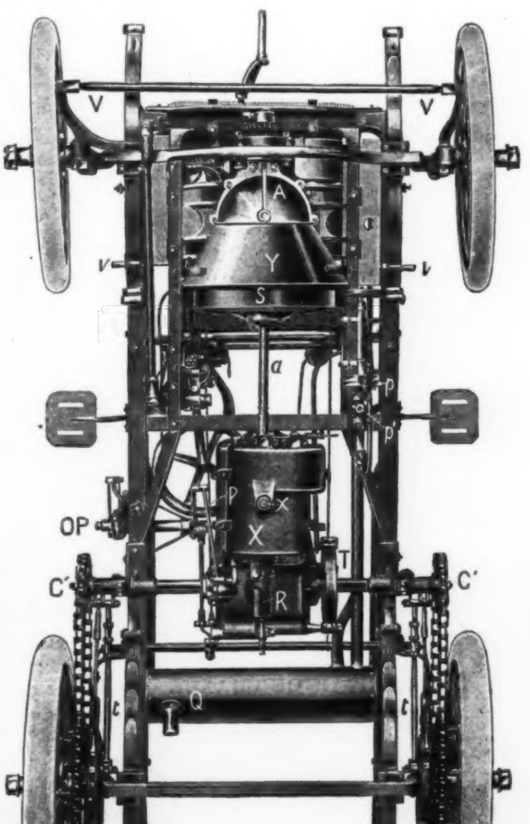


FIG. 2.—BOTTOM OF FRAME.

A, Motor; *a*, Lower shaft of change gear box; B, Radiating coils; C'C', Countershaft sprockets; F F, Band brakes on wheels; G, Cold air pipe to carbureter; I, Pedal for band brake, T; J, Pedal for disconnecting motor; K, Grease cups; L, Oiler for gear box; M, Oiler for motor; N, Gasoline cup for cleaning cylinders; O, Band brake lever; *o o*, Levers for brake cords; P, Change speed lever; *p*, Pump; Q, Muffler; R, Water tank; R', Filling plug; R (Fig. 2), Case inclosing spring for withdrawing shaft, *a*; S, Flywheel; T, Band brake on differential shaft; *t t*, Distance rods for tightening chain; V, Burner box; V V, Steering connecting rods; X, Gear case; *x*, Drain hole; Y, Casing under motor.

by restraining or facilitating the movement of the governor balls.

The flywheel, *S*, of the motor has a conical hole extending inward a short distance from its outer face. Into this opening, the sides of which are slightly roughened, fits an aluminium cone, *Q*, covered with leather. The cone is pressed tightly in contact with the flywheel by a coiled wire spring shown inclosed at *R*, Fig. 2. The pressure is such that the cone adheres but slightly at first and then gradually takes hold. This results in a gradual starting and accelleration of the vehicle, since the cone is mounted on the central transmission shaft, *a*, and connected through the gears to the chains of the vehicle. The operator has only to press on the pedal *J* to move back the shaft *a* sufficiently for the cone *Q* to be withdrawn from the flywheel, which thus disconnects the engine.

The principal change in the gear arrangement of the new Panhard machine consists in the bevel gear drive of the countershaft. The latter is now driven by the bevel wheel *M*, which is constantly in mesh with the bevel *N*, Fig. 4. This does away with the sliding motion of the countershaft, which was formerly necessary when two bevels were mounted on it and the reverse was obtained by shifting from one to the other. (See SUPPLEMENT No. 1311.) Another improvement is seen in the holes in the case inclosing the differential gear, which allow the oil to enter and thoroughly oil this important piece of mechanism. The countershaft terminates in the two ends *H H*, which carry the driving sprockets. The band brake drum is seen at *R*.

Upon referring further to Fig. 4, which is a plan view of the change gear box, the reader will notice three of the gear wheels, *A*, *B* and *C*, are printed a shade darker than the others. These three gears form one piece with a sleeve splined on the lower shaft, which is the one connected with the flywheel of the motor; and they can be moved on this shaft by means of the controlling lever. *A* is the smallest gear, *C* the next in size, and *B* the largest. Above these lower gears are three other wheels, *D*, *E* and *F*, the first of which is the largest, the third the next in size, and the second the smallest. The last named gears are mounted on the shaft that carries the bevel driving pinion.

Upon moving ahead the gear-changing lever, *P*, Fig. 1, which, by means of the arm, *f*, shifts the sleeve carrying the lower set of gears, *A* may be brought in mesh with *D*, as shown in the plan view, Fig. 4, and the slow speed ahead obtained. Pushing the lever ahead another notch, *C* passes by *E* and meshes with *F*, which gives the intermediate speed. The third notch of the lever slips *C* past *F*, and brings *B* in mesh with *E*. As these two gears are about the same size, there is scarcely any speed reduction from the motor to the countershaft on this speed. By moving the lever back to its vertical position, the above mentioned changes are repeated in the inverse order, and the pinion *A* is left in the mesh with *T*. A backward movement of the lever causes the prolongation of the arm that moves the gears to strike boss *m* and slide shaft on which *S* and *T* are mounted sufficiently for *S* to mesh with *D*. As *A* is in mesh with *T* on the central or "off" position of the controlling lever, and as it remains so when the lever is moved backward, owing to the shaft of *D* and *T* and the sleeve of *A* moving together, the reverse is accomplished by *A* driving *T* in the same direction as it drives *D* when on the first speed ahead, and *S* driving *D* in the opposite direction. As soon as the controlling lever assumes a vertical position again, the spring, *R'*, moves the intermediate shaft back to the position shown in the diagram. The change gear box has a three-point support, which does away with any slight deformation the frame of the vehicle may sustain on a bad road affecting the box in the least. The motor is not called upon at any time, therefore, to overcome extra friction caused by the jamming of the gear shafts in their bearings on account of strains on the gear case tending to turn the bearings

This cock is also used to shut off the gasoline when the carriage is put up for the day.

The piping passes under the body and reaches the central needle valve in what is called, because of its shape the T of the burners, below a tube which from time to time is used to clean the inlet pipe.

In order to start the burners, alcohol is poured in two little cups below them and ignited, the needle-valve being kept closed, and the stop cock about half open. Then, when the alcohol is nearly burned out, the needle-valve is opened wide. The burners light immediately and envelop the platinum tubes in a large, blue flame. The tank has a capacity of about ½ a gallon and will supply the burners 7 hours.

The electric ignition system is entirely separate from the tube one. To put it in use, all that is necessary to do is to remove the two large plugs over the exhaust

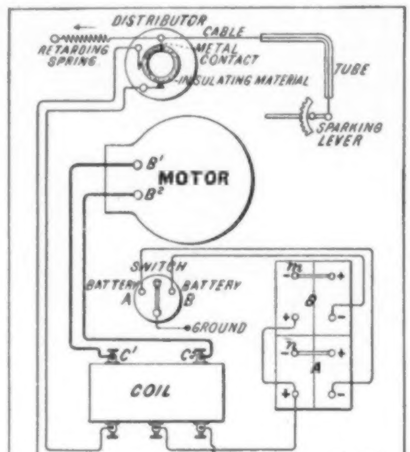


FIG. 5.—DIAGRAM OF ELECTRIC SPARKING CONNECTIONS.

valves and replace them with two special plugs with threaded holes in their centers to receive the spark plugs.

The battery, which consists of two pairs of accumulators, is placed over the right step. A double spark coil with two vibrators, besides a double throw switch and a small lever with toothed sector, is fixed to the dashboard. In the end of the half-speed or cam shaft of the motor is placed the distributors which close the circuits first of one cylinder and then of the other.

The wire connections of the battery are explained as follows: The battery is composed of four cells. Only two of these are in use at one time, the other two being kept in reserve. Therefore, either battery *A* or battery *B* may be used separately, but never together in series, as the voltage would be too high for the coil. By connecting the two positive poles of the two sets together, an extra and unnecessary wire is dispensed with.

Supposing the movable arm of the double throw switch to be swung on the point connected to battery *A*, the primary current will pass as follows: From the + pole of battery *A* it will enter the primary wire of the spark coil at the center terminal, and, making its exit through the right or left terminal, according to which brush is on the metallic contact of the distributer, will pass through this contact to the motor, since the contact is connected with the motor shaft. From the motor it will go via ground wire and switch arm to point *A*,

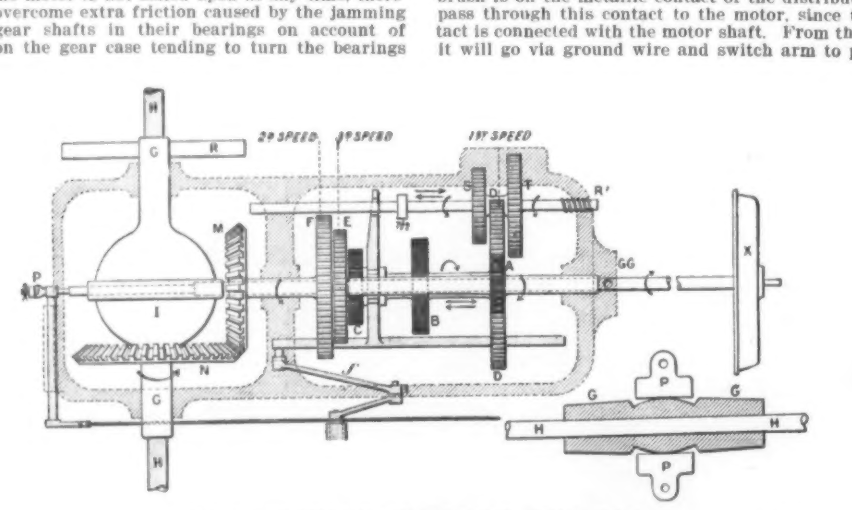


FIG. 4.—DIAGRAM OF CHANGE GEAR BOX.

A, B, C, Gears on lower shaft; D, E, F, Gears on upper shaft; G, G, Bearings of differential casing in gear box; H, H, Countershaft; I, Differential; M, Bevel driving gear; N, Bevel gear on differential; P, End of spring that holds in clutch; R, Brake drum on differential; R', Thrust spring on reverse gear shaft; S, T, Reversing gears; X, Cone of main clutch; *f*, Lever for shifting gears; *m*, Boss for moving reverse gear shaft.

momentarily out of line. The small corner diagram in Fig. 4 shows the cross-section of the differential case *G*, where it is mounted in the change gear box. The olive-shaped form of bearing employed gives the countershaft sufficient flexibility, so that it is never unduly strained by any movements of the frame.

The tube ignition of the light Panhard carriages is accomplished by means of two burners. This kind of ignition is the simplest, most approved, and most reliable. The tank or reservoir of the burners is filled through a hole that has a metal stopper. Below it is a cock that regulates the supply of liquid to the burners. It is generally opened only about half way, so that the burners shall not receive more liquid than they can vaporize and the flame shall always be blue. The extinction of the burners often occurs for this simple reason, viz., that the supply cock is kept too wide open.

and thence to — pole of battery *A*. From there it will traverse the electrolyte of this cell and come out at the + terminal; then it will pass along the connecting wire to the — terminal *n*, of the next cell, and finally come out at the + terminal of this cell, which was its starting point.

It will be seen that the battery *B* has not been in circuit an instant. If it is desired to use this battery instead of *A*, the switch handle is placed on the point corresponding to it. The current will then pass from the + terminal of battery *B*, to the + terminal of battery *A*, and then out through the wires as just described. It will not go through battery, *A*, or affect it in the least, but will have completed its circuit when, having arrived at the — terminal of battery *B*, it has passed through the two cells comprising this battery and reached the + terminal of it.

The secondary current is conveyed from the terminals, C^1 and C^2, of the spark coil to the sparking plugs, B^1 and B^2, by large, heavy, rubber covered wire, and it returns from the motor through the ground wire and switch, and thence through the battery to the center terminal of the coil to which is connected one end of each primary and secondary coil.

The distributor is constantly held back by a spring so that the spark is retarded, except when the action of the spring is counteracted by the sparking lever, which is connected to the commutator by a flexible cord. This lever is mounted on the dashboard and has a notched sector and suitable catch to hold it at any point desired.

As the water cooling system of the vehicle is situated in front around the motor, the pipes are all short and less liable to break, while the cooling of the water must occur infallibly, since the tank itself is located where the full current of air that strikes the front of the carriage may reach it. This tank has a capacity of 5¼ gallons and is fastened to the front side of the dashboard. A pipe descends from its bottom to the pump, which is a centrifugal one run by friction from the motor flywheel. The other side of the pump is connected with the top of the radiating coil *B*; the bottom of the coil with the bottom of the water jacket; and the top of the water jacket with the top of the tank.

Should a leak occur or the pump cease to work a vent in the top of the tank would allow any steam generated to escape and not injure the piping. A three-way drain cock is placed next to the pump for the purpose of draining the jackets of the motor and the coil and tank in cold weather.

The lubrication of the vehicle is accomplished by means of oilers and grease cups. Oil is used for the two cylinders of the motor and for the change gear box, the oilers being mounted on the dashboard in full view of the driver. The little oil cup on the lower shaft near the motor should be filled about once in every 150 miles. *N* is an oil cup for gasoline to be used in cleaning the cylinders once in a while, should the rings become gummy and stick.

Grease cups are used on the countershaft, steering gears, pump, etc., and these should be given a turn once in 150 miles or so. A large central grease cup contains a piston that pushes out the grease and distributes it to the forward end of the upper shaft of the change gear box, and to the two bearings of the countershaft in the box. To fill this grease cup, the piston should be driven to the bottom by turning the screw on the end of which it is mounted. The cup can then be filled and replaced.

This finishes the description of the light Panhard-Levassor carriage. It is short but quite complete. Is it not a good proof of the simplicity of the mechanism that I am obliged to stop at this point because there are no more parts to be described?

In closing, I must mention two things further, as follows: (1) The construction is irreproachable. It is signed Panhard! (2) A fine set of tools accompanies every machine and is delivered to the purchaser with it.

Formerly, in automobile commerce, there was delivered with every vehicle a monkey wrench, a small screwdriver, and a few second-hand screws, all wrapped in a piece of oiled paper. To-day a good kit of tools is a necessity for an automobile trip.—L. Baudry de Saunier, in La Locomotion.

NEW BRAKES FOR AUTOMOBILES.

THE brakes of automobiles, especially those of the heavy gasoline machines, are one of the principal sources of trouble. It has been said that the adjustment of most of them is very difficult, sometimes even impossible. There are springs right and left, above and below, for the purpose of holding in equilibrium the various bands, jaws, rods, etc. They bind too tightly or not at all; they heat; they break; they make the carriage skid. Scarcely any of them really hold equally in both directions, so that, on a steep hill, the carriage can only be stopped and held in place by a special holding rod or a friendly rock. Some of them, if one is imprudent enough to use them when the carriage is backing, twist out of place and become entangled with the nearby chains. Many of the best cannot stand long and rapid descents. The best of them are but speed slackeners and not brakes.

"All these complaints must now be put aside. The era of brakes which are brakes seems at last to have come," says the editor of La Locomotion, in describing the new braking apparatus which was on exhibition at the recent Paris Automobile Show; "and at all the stands, I was pleased to find that the study of this important question has resulted in several interesting innovations."

The firm of Charron, Girardot & Voigt exhibited a model frame, on the rear wheels of which were shown brakes of a new pattern consisting of a flat ring inside the sprocket of the wheel, with two opposed brake

THE NEW CHARRON BRAKE.

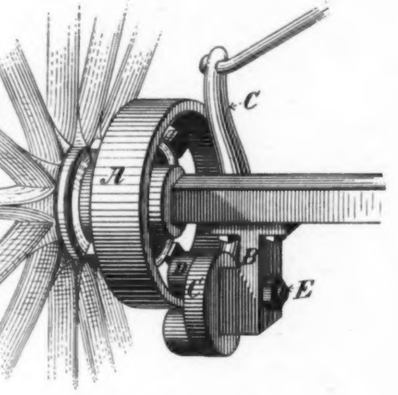
shoes mounted within it. The chief features of this new brake, as described by the inventors, are as follows: (1) The tension of the tightening rod, *m*, is produced in a vertical plane very near the plane of the chain itself, which allows the use of a lighter spring, and also gives less opportunity for the misalignment of the chain. (2) When the brake is applied, the distance rod, *n*, for tightening the chain, is subjected to a pulling strain while the rod, *m*, is compressed; and these forces are applied to the frame at the point

where the rods meet and are fastened to it. The result is that the supports of the sprockets do not have to stand any strain except the slight one resulting from the difference of the pushing and pulling forces, while in most of the brakes usually employed the supports have to withstand the sum of these two forces. Moreover the springs, the chains, the brakes, and even the operating cords move around the same center, which is the axis of the sprocket supports; and as a result of this arrangement of parts, there can be no jamming of the brake when the carriage runs into a bad hole or gully. Finally, as a still more interesting detail it should be stated that the wheels can be removed without upsetting the braking system in the least, and the brakes can always be depended upon to hold firmly whether the carriage is going ahead or backing.

Among the other brakes that operate by friction should be mentioned that of the Lemoine Company. The Lemoine brake has an established reputation; it is used on the omnibuses of Paris and for all heavy traction in general, and it consists of a combination of a roller on the hub and a friction shoe on the iron tire of the vehicle. This brake could not be applied to the pneumatic tires of an automobile, so M. Pailliard, the successor to M. Lemoine, invented a similar system—the rim brake—which captured the prize in the braking contest conducted last August under the auspices of the Touring Club of France.

In constructing this brake a slightly smaller inner rim is fastened to the rim proper of the wheel, and a braking shoe of aluminium is set so as to be pressed against the inside of this rim by a suitable lever arrangement. The brake operates with considerable force, and no heating, sticking, or non-operation because of mud or dirt is to be feared.

The latest innovation in brakes is the roller brake designed by M. Rossinier. This consists of a flat ring, A, fastened either to the hub or to the spokes of the



THE LEMOINE BRAKE.

wheel; of a lever support, *B*, clamped to the axle; and of a lever, *C C*, pivoted on the pin, *E*, and carrying rollers, *D*, which bear on the inner and outer surfaces of the flat ring. No brake can surpass this on the score of simplicity. It will not heat, and neither oil nor mud will affect it. In the braking contest mentioned above, it received first prize in the class of brakes acting on the hub.

Finally, a description was given during the show of a new magnetic brake that acts in both directions and on all four wheels at the same time, but it is hardly advisable to dwell on this invention, as it has not as yet been made to pass under the harsh rod of experience. It shows, however, the effort toward progress which is all the time being made and which will serve to render automobiles more obedient still than they already are at present.

PARTIAL USE OF DECIMAL SYSTEM THIRTY-FIVE YEARS AFTER LEGALIZATION.

THE process of transition to the use of Federal money, inaugurated by resolutions of the Congress of the Confederation, July 6, 1785, and August 8, 1786, was protracted through the time of our grandfathers, the generation following that which established the money. Kelly's Universal Cambist, whose preface is dated in 1821, thirty-five years after the original legislation, is a standard authority, having had official support. It said of the United States:

"Accounts are kept here in different ways, but chiefly in dollars, which are divided into 10 dimes, 100 cents, or 1,000 mills. This is called Federal money, to distinguish it from the various currencies which were formerly the monies of the United States, and which are still partially retained in domestic traffic," etc.

The constitution of Massachusetts said then, and says now in Chapter VI:

"III. In all cases where sums of money are mentioned in this constitution, the value thereof shall be computed in silver, at six shillings and eight pence per ounce," etc.

The United States Mint, though it began to coin money in 1793, did not strike many coins except cents, half-cents and half-dollars down to 1820; and coins of the several nations of western Europe continued in circulation. The Spanish original of our dollar was well known as the "piece of eight," meaning eight "bits" in the vernacular tongue of the United States, where the Spanish name is less familiar; one bit thus becomes 12½ cents obviously to us, but our grandfathers knew it as of the value expressed according to their long-established custom in their different monetary reckonings. John Quincy Adams, Secretary of State, in his celebrated report on weights and measures, also dated in 1821, wrote as follows:

"Now, when the recent coinage of dimes is alluded to in our public journals, if their name is mentioned, it is always with an explanatory definition to inform the reader that they are ten-cent pieces; and some of them which have found their way over the mountains, by the generous hospitality of the country, have been received for more than they were worth, and have passed for an eighth, instead of a tenth, part of a dollar. Even now, at the end of thirty years, ask a tradesman or shopkeeper in any of our cities what is a dime or a mill, and the chances are four in five that he will not understand your question. But go to New York and offer in payment the Spanish coin, the unit of the Spanish piece of eight, and the shop or marketman will take it for a shilling. Carry it to Boston or Richmond, and you shall be told it is not a shilling, but nine pence. Bring it to Philadelphia, Baltimore, or the city of Washington, and you shall find it recognized for an eleven-penny bit; and if you ask how that can be, you shall learn that, the dollar being of ninety pence, the eighth part of it is nearer to eleven than to any other number," etc.

This was characterized by Mr. Adams as absurd, and justly. Oh, yes—but—by the way, what is it that we are doing, A. D. 1901, thirty-five years after the inauguration by our fathers by the Act of Congress of July 28, 1866, of the change to metric weights and measures? Our rates of postage on foreign mail matter are by weights in grammes, and we try to look them up in pocket diaries or other common places of reference and find them inaccurately stated by weights in ounces. We turn to the Revised Statutes of the United States, Section 3515, referring to our minor coins, and read:

"The weight of the piece of five cents shall be seventy-seven and sixteen-hundredths grains troy." A circumlocution for five grammes. We have had profile paper printed with metric subdivisions for its whole length and have measured it off in portions for sale by the yard. Imported paper in rolls of ten meters we have advertised as eleven-yard rolls. These few examples suffice out of many instances of misapplication of units of quantity in business and in publications.

We see the unreasonableness both of the Massachusetts constitution and of the adherence of our grandfathers, so long after they had established decimal reckoning, to their antiquated bookkeeping, which occasioned great inconvenience from the incongruity of the two methods in use at the same time. When our grandchildren look back to 1901, what will they say of our now hanging on to weights and measures that are out of date by consequence of the substitution of the metric units legalized thirty-five years ago?

Consider electricity, whose standards of measurement are fixed upon a metric basis by the law of July 12, 1894. The following is an extract from it:

"The unit of power shall be the watt, which is equal to ten million units of power of the centimeter-gramme-second system, and which is practically equivalent to the work done at the rate of one joule per second."

Several of the electrical units have become familiar to us through the enormously rapid development of the applications of electricity. This is the case especially with the kilowatt, a commercial unit which we meet with in almost every technical publication we take up; but it has not yet entirely displaced that anomalous old unit, the horse power (as to which reference may be made to Engineering, vol. 63, pp. 245 and 325, for February 19 and March 5, 1897).

Consider the matter of assaying and coinage, in which the metric system is established. It has been used in the Mint for years, and is used in published tables or schedules of coins. The United States subsidiary silver money weighs one gramme per four cents, and thus metric weight is in everybody's pocket. The troy pound has dropped out of practical use. Nevertheless, the troy ounce, incongruous as it is with other weights and measures, still comes in our way sometimes (in other places besides the Massachusetts constitution).

Consider pharmacy and some other matters connected with chemistry. The United States Pharmacopœia, the reference manual of the apothecary, is exclusively metric. The Dispensatory, the corresponding manual of the physician, has metric values throughout. The use of the metric system was introduced in the United States Marine Hospital service about a quarter of a century ago quite thoroughly, and in the army and navy more recently. In practice in civil life prescriptions are to a large and increasing extent written in metric terms; but the mysterious old "apothecaries'" weights and measures (which for sales of candy and popular wares are not used by apothecaries) continue to be used in the prescriptions of some of the older physicians, who in the natural course of events, are gradually passing off the stage. Meanwhile pharmacists have double sets of weights and measures, and employ clerks who understand both, with extra trouble, cost and risk of mistake. In the sale of high grade chemicals the metric system has been introduced. E. R. Squibb & Sons, of Brooklyn, have used it exclusively for nine years, and the Bausch & Lomb Optical Company, of Rochester, issues a sixty-page priced catalogue "G" of "Chemicals and Reagents" in metric terms, with a conspicuous notice at the top of each page, "Prices of Chemicals are by Metric, NOT Avoirdupois Weight." Much glassware and rubber stoppers are made to metric scale. As to chemical manufacturing, all the tanks in a factory built by the Merrimac Chemical Company, of Massachusetts, for their extensive sulphuric acid works, were made on metric dimensions, and the Pennsylvania Salt Manufacturing Company have built a large plant entirely upon metric dimensions. The great Solvay Process Company, of Syracuse, makes use of the metric system in every way possible in its works. Drawings to go outside of the works for construction, etc., are not made in the metric system. The company says it finds no disadvantages, and would be very glad if its entire work could be upon the metric system. That means that as long as people outside cling to ancient weights and measures, so that conformity with them is required of the Solvay Process Company, the company gets only part of the advantages naturally belonging to its system. Chemical analyses are expressed in parts per million, per hundred thousand or per thousand, corresponding to grammes per cubic meter, per hektoliter or per liter. Grains per gallon are out of date. Nevertheless, in dealing with quantities and consumption of water there still lingers some use of the United States liquid gallon, a unit long ago abandoned in Great Britain and Canada, distinguished for its lack of connection with other measures or weights, and not ordinarily used in the reading of water meters.

Consider geodesy and precise leveling. The metric measure has been very extensively used in precise leveling or other work of the United States Coast and Geodetic Survey, the United States Geological Survey, the United States Lake Survey, and the surveys under the Mississippi River Commission. Among other literature from which evidence may be obtained about this, and about working in old measures incongruous with metric, there is an article and discussion on "Precise Spirit Leveling," occupying pp. 1-206 of vol. 45 of the Transactions of the American Society of Civil Engineers, June, 1901.

Bulletin No. 26 of the United States Coast and Geodetic Survey, dated April 5, 1893, contained an announcement signed by T. C. Mendenhall, Superintendent of Standard Weights and Measures, and approved by John G. Carlisle, Secretary of the Treasury, from which the following is an extract:

"The Office of Weights and Measures, with the approval of the Secretary of the Treasury, will in the future regard the international prototype meter and kilogramme as fundamental standards, and the customary units, the yard and the pound, will be derived therefrom in accordance with the Act of July 28, 1866. Indeed, this course has been practically forced upon this office for several years," etc.

The Treasury Department is the department to which are attached the Mint, the Marine Hospital Service and the Coast and Geodetic Survey, in all three of which, as above stated, the metric system has been in practical use for years. Incongruity is found, however, in the fact that the Treasury Department continues the use of old weights and measures in other branches of its work; for example, in its Bureau of Statistics, largely occupied with foreign trade (whereas metric units have been introduced to some extent in the Bureau of Foreign Commerce of the State Department and in the Section of Foreign Markets of the Agricultural Department); and, for another example, in the Customs Service, where there will be special gain in the substitution of the international system, and where its substitution has been repeatedly urged, officially and unofficially.

Consider manufactures: The April, 1900, report of the American Railway Association's Committee on the Metric System enumerated among manufactures in which the metric system has been introduced watches, injectors, refrigerating apparatus, screw-cutting lathes, scales, drills, gages, astronomical and physical instruments, measuring implements and draughtsmen's supplies. A very large number of manufacturers have had some call for the application of metric measurement for goods for export, if only on a small order; and goods of widely diverse character are among the metric manufactures. We have exported to metric countries a great deal of ordnance and machinery for manufacturing ordnance, and rapid-firing guns have been designated by their caliber in millimeters. The Baldwin Locomotive Works' illustrated catalogue of narrow-gage locomotives has printed on its title page, "Adapted Especially to Gages of 3 Feet 6 Inches or One Meter," and on each of the sixteen pages (108-38), on which are tabulated various types of locomotives, has printed conspicuously, "Gage, 3 Feet 6 Inches, or One Meter." The Library Bureau, of Boston, has cards and cases made of exact metric dimensions. In the Electrical Review (New York) for June 22, 1901, Geo. H. Draper says:

"There is no first-class shop in America that will not undertake to build machinery according to metric measurements, and many of them are at the present time compelled to build stock forms of machinery in measurements of this system in order to be able to compete for trade in foreign countries where the specifications are given in round metric terms."

The following sentences are quoted from the American Manufacturer:

"The metric system is making some headway among American manufacturers engaged in the export trade. This is especially true of machinery builders. It will continue to make headway according to the increase of our exports. . . . There are firms that have adopted the metric system for their export business. They do not seem to be suffering from the effects of having two sizes of templates and dies for their plants. They are filling orders for export and are teaching their workmen the use of the metric system in so doing."

The incongruity of having two sizes, whether there seems to be suffering from the effects or not, continues until the superseding in domestic trade also of old weights and measures by metric. A similar remark may be made in regard to United States importations of bottled goods, textiles and other manufactures from foreign countries where the metric system is in use.

Consider bodily measurements, etc. The stature and strength of athletic young men in the colleges in different parts of the country are recorded in metric units and are published; but sometimes the newspapers, instead of recognizing the kilos, call them "points." Dimensions of statuary, etc., have been given metrically in the reports of the Boston Museum of Fine Arts regularly for many years. There is great convenience in measuring the cloths, as well as the body, in centimeters, not requiring fractions; and among men's furnishing goods some suspenders may be found with the length marked upon them in centimeters; but there remains in principal use for the measurements of tailors and dressmakers, and for sizes of such things as gloves and hats, the old unit with the ubiquitous fraction.

Consider applications of science. The metric system has been thoroughly adopted for scientific research upon all subjects and for the diffusion of scientific knowledge by publications and educational institutions. The extent of its use for instruction, laboratory supplies, apparatus, etc., is enormous; yet when scientific knowledge is utilized in technical work for commercial purposes it often happens that old units of measurement are employed; so we have the incongruity of preaching one thing and practicing another, of producing certain effects with one measure in investigation and with another measure in business. Such complications are now a characteristic feature in our literature, the discussions of our professional organizations, reports of committees of research, periodical publications, or books of the day. Similar complications are common in shops, offices and practical work, a fact so familiar as to require little illustration. Fineness of sand is expressed by the millimeter, and fineness of the sieves

and screens for it by the number of meshes per inch. It is by the cubic centimeter of water that the number of bacteria are reckoned in biological examinations, but, rather than say so, men otherwise intelligent have sometimes disguised it for the popular mind as "thimbleful." Opticians have adopted metric measure, and, besides whatever else they have done in regard to their apparatus and accessories for microscopy, etc., they have a metric basis for expressing the power of lenses of spectacles. Their "dioptrics," depending on the focal length in meters, are found in the optician's price list; yet it is not uncommon to express the diameters of lenses in old measure, which may be found even in the same catalogues that give generally the metric system.—School Science.

A MODERN STEAM LAUNDRY.

Although the fundamental principles of washing clothing have remained the same as in olden times, the mode of effecting the work has of late undergone a radical change in the large cities, and few housewives know what happens to their wash when they give it to the large steam laundries. Only establishments of great dimensions can handle the enormous mass of soiled linen, etc., that has to be cleaned in a city like Berlin every day. The consumption of laundry is so great that Berlin restaurants, hotels, factories, banking houses, etc., have no linen or laundry of their own, but like electric plants and other establishments that use polishing rags in large quantities, hire it from the large steam laundries, which combine a lending business with that of cleaning. One firm in Berlin (Fr. Wagner) alone lends out and washes no less than eight hundred thousand bed sheets every year. When we learn that the Central Hotel used to spend annually 96,000 marks for the cleansing of wash, we will understand that they had rather set up a steam laundry of their own. The annual bill alone for the washing of mail pouches in Berlin, for instance, is 42,000 marks. It is more and more becoming the fashion for well-regulated households to give their laundry also to the large steam power concerns. Seven years ago there were in Berlin only seven large washing concerns equipped with all the latest machinery, taking the place of domestic and rural washing methods. Within that short space of time of seven years their number has increased to more than forty.

The "Germania," a large steam laundry at Steglitz, near Berlin, may well serve as a pattern for the description of such an establishment, because it is fitted with all the modern machinery and cleans domestic wash as well as any other kind of laundry and also conducts a lending-out department. This concern employs over a hundred, mostly female hands, outside of the drivers, machinists and delivery boys.

The interior of the building shows light rooms of good breadth and height, whose blue and gray decoration in conjunction with the fragrant linen which, partly finished, meets the eye at all sides, immediately making a favorable impression.

All the machines are driven by steam power by transmission from one point, there being washing, rinsing, and ironing machines, steam calenders, rollers, drying apparatus and ventilation contrivances, curtain stretchers, etc.

From the boiler room a view is afforded upon the spacious yards, where neat vehicles, drawn by pretty horses, are bringing in the laundry from all parts of the city.

All the bags and bundles are first taken in hand in the marking room. This department is one of the most important of the whole concern. Here the various lots are checked off, so as to avoid subsequent difficulty arising from missing pieces or errors in previous counts. After the pieces have been marked by means of colored threads according to the lots, they are assorted in such a manner as to keep those of one lot together, as far as possible, while colored wash and such that has to be treated separately for fear of discoloring or for sanitary reasons, is laid aside to be washed by hand in special tubs. The other pieces are sent to the washing room on the ground floor to be placed directly in the washing machines.

Such a washing machine is a simple, but ingenious device. A perfectly smooth drum of pure copper moves in a kettle surrounding it, to which steam, hot or cold water can be admitted as desired. Into this drum, which is fitted with sieve-like holes, the soiled clothes are packed, good soap being added in large quantities. The drum is closed and moves automatically, now to one side now to the other, around its axis, while hot water flows in through the sieve holes and covers the laundry. By this simple procedure the pores of the wa[illegible] are opened, the adhering dirt dissolves, and b[illegible] the dirty water running off continually and clean water flowing in, the cleaning of the wash is accomplished in a surprisingly short time and without any injury to the material. It is of a dazzling whiteness when it leaves the machine.

The opened drum turns downward, and without being touched by a hand, the finished wash drops into a wagon rolled underneath, to be at once carted to the rinsing machine.

The last-named machine consists of a large vat holding about six cubic meters, which is filled with water kept in constant motion by paddle wheels. The clothes remain therein until freed from any soap that may still be adhering. To accomplish this, first hot, then cold water is caused to run in from gigantic reservoirs above, while the spent water flows off continually.

From the rinsing machine the wash reaches the centrifugal drying machine. This centrifuge likewise consists, essentially, of a perforated copper drum, which, however, turns vertically instead of horizontally and is completely open at the top. After this drum has been carefully packed full of wet wash, it is set in rotary motion. Owing to the velocity of the revolutions, the water is spun out, so that after three to five minutes only very little water remains, which is allowed to stay in, as it is necessary for the further treatment of the pieces.

Upon the centrifuge the chief work of cleansing is finished, and the clothes are now taken to the work room, where the machines and apparatus which put the finish on the pieces are located.

We do not see any ironing of fine wash such as collars, cuffs, etc., going on anywhere. This is explained by the fact that one of the latest and most interesting productions of the washing industry, viz., an ironing machine, is at work here.

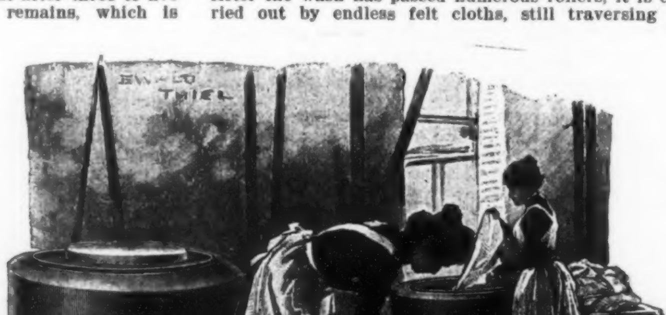
This machine consists mainly of a polished steel roller, which drives a table underneath it to and fro. This table is covered with a soft material. Hence the roller takes the place of the flat-iron and the table that of the ironing board. After the roller, which is hollow, has been sufficiently heated by gas, the previously starched collars, etc., are simply spread on the ironing table and the machine attends to them automatically.

We still have to witness the treatment of the smooth wash, which had been separated after the drying, from the body linen. The same is conveyed to the steam gloss-calenders. The working capacity of these machines is astonishing, a single calender being capable of smoothing no less than 20,000 towels per day. The steam calenders are incessantly fed with moist wash by skilled female hands.

The pieces are carried over a highly polished steel cylinder by soft frieze-lined rollers and leave the machine in twenty to thirty seconds perfectly dry, ironed and finely finished. This is accomplished by the hollow cylinder of the calender being heated with steam; by its rotary motion it smooths and puts the finish on the linen, so as to make it look like new. After the wash has passed numerous rollers, it is carried out by endless felt cloths, still traversing an

AT THE STEAM CALENDER.

DRYING THE LAUNDRY.

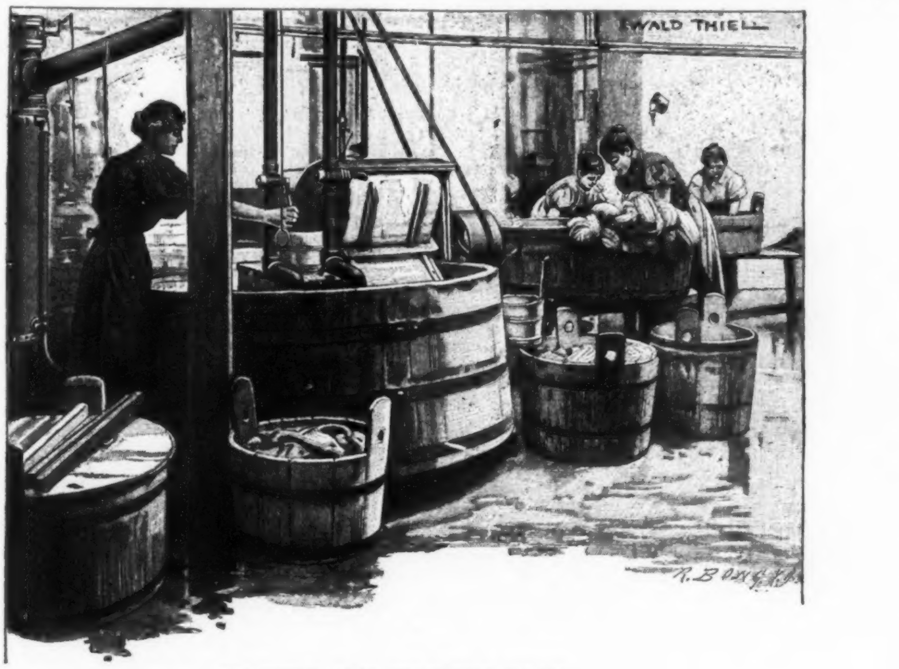


LARGE WASHING DRUM.

ironing box which eliminates any remaining defects, and is then passed on to the folding department. Here it is folded by deft hands and packed up in large piles. It finally reaches the assorting rooms. This department forms the central terminus, where all the many threads of the large establishment converge. Especially experienced hands now rearrange the different lots.

In the shipping department numerous girls are engaged in putting the finishing touches to the laundry, by tying it up with bands and bows, so as to give it a neat appearance, when it is delivered to the customers the following morning.

For our engravings and the accompanying particulars we are indebted to Fuer Alle Welt.



RINSING AND WASHING ROOM.

THE CONTROL OF PIGEON RACES.

IN the raising of pigeons, an important question is that of knowing accurately and positively the time at which the birds return to their cote. In races in which prizes are offered, the time that has elapsed between the start and the finish is reckoned for each individual, and the one that has made the trip most rapidly is of course regarded as the winner. Now since the birds belong to various owners, whose cotes are situated at different points of the region, it is important, in order to prevent any attempt at fraud, to have a very sure of method of control that shall permit of ascertaining the time consumed by a certain pigeon, and that, too without its being known to the person who has an interest in winning the race.

Stated in a general way, the process employed is to mark the pigeon with a sign (either by means of a ring riveted to the leg or a number engraved upon the wing), at the time at which the owner delivers his bird to the organizers of the race. As this sign is unknown to all, it is certain that there can be no trickery on the subject of the pigeon that has competed, and that it is impossible at the moment of return to substitute one individual for another.

The difficulty resides especially in the control of the time. In former days, the owner had to watch his cote for the return of his bird, and as soon as the latter had re-entered he seized it and put it into a bag and ran with it as fast as possible to the central seat where the reconnaissance was making. The time that had elapsed from the start, inclusive of the time taken to carry the bag containing the pigeon, was then immediately noted. The distance between the cote and the seat of the society that had organized the race was also naturally taken into account. A calculation of reduction was likewise made for those whose residence was situated nearer the place where the start was made. Thus, an owner dwelling at Montrouge had a mile and a quarter start of one whose house was situated at Villette, in supposing that the race began at a point to the south of Paris. A proportional calculation was made in order to equalize the distances. This process was primitive and barbarous. The bird, on its return from a fatiguing trip, always resented being shaken up in a canvas bag, and, on another hand, the method was uncertain, since a wealthy owner, being able to establish relays of runners, had a great advantage over one who, less favored, was obliged to make the trip in person. So the system was changed, and recourse was had to home controllers, who were provided with watches inclosed in a glass box sealed with lead, and the correctness of which had been previously verified by comparison with the timepiece in possession of the judge of the competition. But here again a serious inconvenience was encountered. It was necessary to appoint as many controllers as there were contestants, and it was not always possible to make sure of their impartiality and resistance to bribery.

At present there is usually employed an automatic apparatus that registers the time of the pigeon's return with scrupulous accuracy, that permits of dispensing with human controllers, and that has the advantage of being protected against any attempt at fraud. This apparatus consists in principle of a clock placed in a closed and lead-sealed box (Fig. 2, No. 3), and which every owner has to examine on the eve of the race, in order to ascertain whether it runs slow or fast. The hands of this clock are double. In the first place, it has visible hands that revolve around a dial in the ordinary manner, and in the second, two hands operatively connected with the first and each provided with a pin at right angles with their surface, *C* (Fig. 2, No. 4). We shall see the use of these further along. At the upper part of the box there is a small window, *A* (Fig. 2, No. 2), behind which there is a sheet of paper mounted upon a light metal frame. Upon the back of this paper are printed two dials, one for marking the hours and minutes and the other the seconds (Fig. 2, No. 3). As we said above, the wing of the pigeon is, before starting, marked with a sign. This, as a general thing, consists of four figures followed by a letter, say 3428 B, for example. These figures are engraved by means of a special machine, and precautions are taken that they shall be unknown to everybody, even to the person who presides at the operation. This machine likewise engraves these figures upon a card upon which are inscribed the general data as to the bird, such as its sex, markings, etc., and the name of its owner. At the moment of recording, the card disappears in a drawer closed by a key and sealed with lead, and which must not be opened until after the race. It will be seen that with such precautions no indiscretion is possible. The owner who has an interest in winning the race must be near his cote at the moment of the bird's return. As soon as the latter has re-entered, he seizes it, reads the figure inscribed upon its wing and quickly inscribes it upon the sheet of paper placed behind the window, *A*, of the apparatus (Fig. 2, No. 1). Then he revolves the winch, *F* (Fig. 2, No. 2), and the sheet presents itself in front of the hands provided with pins. These latter then prick holes in the dials printed upon the sheet of paper. A second revolution of the winch causes this bulletin to pass into a compartment, *G*, of the instrument (Fig. 2, No. 2). It is then possible to begin another operation of the same kind. In this way there is obtained a valuable document in which has been accurately registered the time of the pigeon's return, without any fraud having been possible.

The box is then carried to the central seat of the competition. The judge, after ascertaining that the lead seals of the apparatus are intact, opens the latter and takes out the bulletins. The necessary calculations are then made for averaging the distances of the competitors, and the data thus obtained show which of the birds has made the trip most rapidly.

At present the use of this apparatus is obligatory in all pigeon races in France and Belgium, and all those who wish to participate therein are required to possess one.—For the above particulars and the accompanying illustrations we are indebted to La Nature.

VISCOSE AND ITS PREPARATION.*

WOOD cellulose (100 grammes) is treated with one per cent chlorhydric acid for several hours, expressed and washed. The mass is then brought in contact for one hour with 40 grammes of caustic soda dissolved in 200 cubic centimeters of water, and left in a closed vessel for three days. 100 grammes of carbon sulphide is added, and it is set aside for 12 hours. The viscose thus formed is dissolved in cold or warm water, forming a pale brown solution. It is precipitated from this solution by alcohol and sodium chloride, which purifies it, though at the expense of its solubility.

The purified product gives a colorless or pale yellow solution, decomposing under the influence of heat and acids, the same as when standing for sufficient time. In these conditions it is separated into cellulose, caustic soda and carbon sulphide. The regenerated cellulose holds the alkali closely. It is very difficult to free it; which is an obstacle to its use as a substitute for ivory.

A solution of viscose, essentially neutral, yields a colorless precipitate with salts of heavy metals; with

* From the German of H. Seidel, in the Kaiserliche Technologische Mittheilung, Vienna.

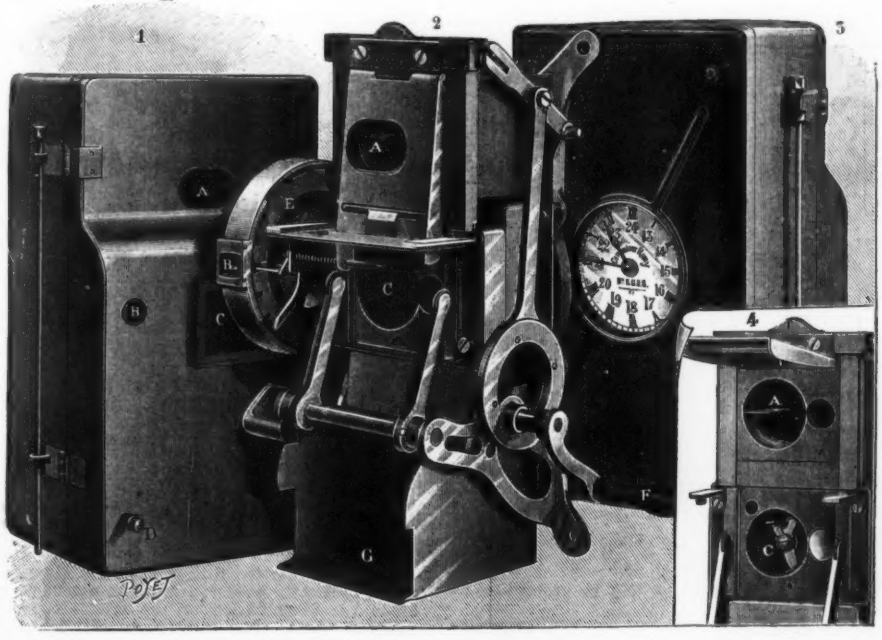


FIG. 2.

No. 1.—Receiver of a Remy controller. No. 2.—Details of the internal mechanism. No. 3.—Internal view of the apparatus. No. 4.—Arrangement of the cards.

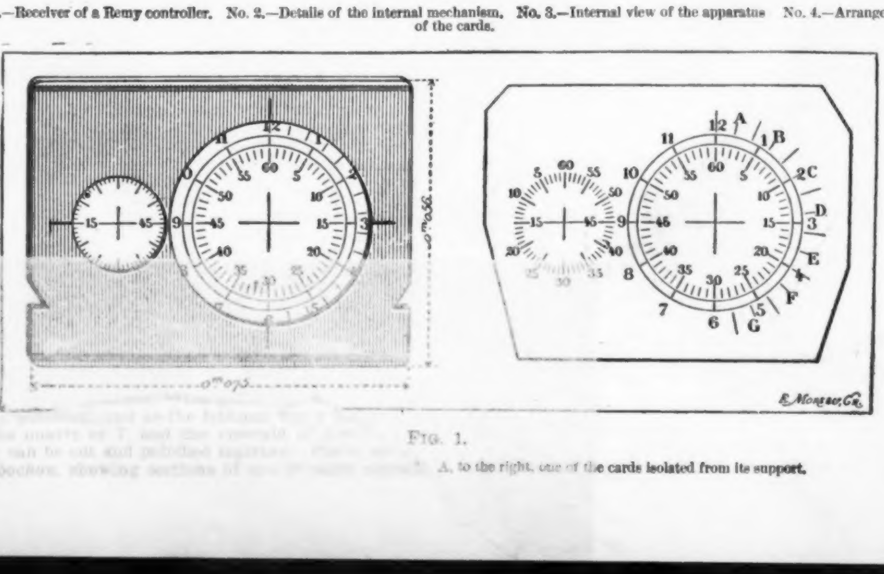


FIG. 1.

A, to the right, one of the cards isolated from its support.

iron, the precipitate is reddish brown; with lead, it is orange red; silver gives a crimson precipitate; mercury, a yellow; nickel, a pale red. The intensity of the coloration seems to correspond to the proportion in the viscose of sulphides and of alkaline carbonates, as the purified product gives birth to less highly colored precipitates. These precipitates respond probably to the formula XO-CS-SM, in which X represents the cellulosic residue and M a metal equivalent to an atom of sodium. They decompose more readily than the sodic combination.

Mordanting of Cotton with Iron, Aluminium and Chromium, with the Aid of Viscose.—The cotton product is impregnated with a solution of viscose, expressed and submitted to the action of the acetate of one of the metals mentioned above and dried. After having been well washed, it is ready to be colored.

Films of Viscose.—A piece of cotton cloth is treated with dilute chlorhydric acid, washed and immersed in a concentrated solution of caustic soda. It is then submitted in a closed vessel to the action of the fumes of carbon sulphide. Thus, the cotton, without losing its structure, is transformed into viscose. This is treated with water, sprinkled on a glass plate, and left for evaporation at the ordinary temperature.

At the end of two days, the film produced is dried in a steam desiccator; it becomes brown and brittle. To complete the decomposition of the viscose, it is treated with acetic acid. In this way a film is obtained, transparent, flexible, of a pale brownish yellow, and not having the structure of cotton. It can be whitened by calcium chloride, or any desirable color can be imparted, while its transparency is retained. It softens at 100 deg. C.

ACTION OF ALCOHOL ON FATS.

IT is not correct to say that all fats are insoluble in alcohol. Every rule has its exceptions. It has been long known that butter is partially soluble. Chevroul in his experiments found that one hundred parts of boiling alcohol, of a density of 0.22, dissolved 3.46 parts of butter.

M. Duclaux, the learned director of the Pasteur Institute, has, after patient research, demonstrated conclusively that alcohol has a greater or less action on fats, and consequently confirmed the results reached by the celebrated inventor of the stearic candle. Allowing that butter is quite a homogeneous mixture, it is unquestionable that its elements do not enter into solution in identical proportions. Thus alcohol dissolves more butyrine than other substances. The matters in solution are not found in the state of free acids, but are found in the state of fats.

In his experiments, M. Duclaux had need of ascertaining previously the quantity and the nature of the materials dissolved in butter by alcohols of different strength. For the quantity, he had only to digest for a sufficient time the fatty matter and the alcohol at a high temperature, then to allow the mixture to cool in a way to assure the saturation of the alcohol.

But to ascertain the composition, it was necessary to take certain precautions. In order to be sufficiently exact, it is requisite to have the butter in great excess, so that the solution of different constituents, caused by the alcohol, may not change the nature of the portion remaining undissolved. This is not one of the ordinary cases of solubility, where it is only necessary to introduce a slight excess of the substance to be dissolved. There is a phenomenon of molecular equilibrium, of which account must be taken. The fatty matter not dissolved disputes with the alcohol the matter that has entered into solution, and the more so, as the alcohol becomes impoverished. This antagonistic action cannot be avoided, but can be rendered nearly constant by allowing the composition of the butter not dissolved to be nearly constant, notwithstanding the solution. This is possible by introducing it in great excess.

The experimenter has made use of melted Prevalaye butter, which he has digested with alcohol of 60 deg., 80 deg., 92 deg., and with absolute alcohol. In the latter case the figure obtained was only approximative because the butter had retained a little water, which had slightly hydrated the alcohol, and because of the solubility of butter in this liquid. The butter was not in sufficient excess.

The quantity of butter that remained in solution in alcohols, brought to the normal temperature of fifteen degrees, were the following:

6.54 per cent in absolute alcohol.
0.53 per cent in alcohol of 92 deg.
0.10 per cent in alcohol of 80 deg.
0.03 per cent in alcohol of 60 deg.

These quantities decrease rapidly in proportion as the alcohol is diluted.

Studying the matters dissolved with reference to their richness in volatile acids, the following figures were found:

Absolute alcohol, 6.1 per cent of volatile acids.
Alcohol of 92 deg., 11.5 per cent of volatile acids.
Alcohol of 80 deg., 12.5 per cent of volatile acids.

It is evident that the proportion of glycerides with fatty acids gradually increases in the portions dissolved and that the proportion of butyric acid to caproic acid changes also in the dissolved portion of the glycerides with volatile acids. Consequently the two acids are nearly equivalent in the portions dissolved by absolute alcohol, which dissolves more caproin than butyrin, without however causing very great differences in the constituents of the butter. It is to be supposed that this difference would have been still less, if the alcohol had been employed in a state absolutely anhydrous and in presence of a greater excess of butter.

The same phenomena are observed by using wood spirit. Having digested methylic alcohol of 16 deg. with Isigny butter, M. Duclaux has ascertained that the solution contained 0.27 per cent, and that the proportion dissolved contained 11 per cent of volatile acids, in which there were two equivalents of butyric acid for one of acetic acid.

After these preliminary experiments, M. Duclaux wished to discover if not to analyze the resin which might be found in isolated butter.

As the alcohol of 90 deg. dissolves little of the fatty matter of the butter, and on the contrary dissolves readily most of the resins, he endeavored to digest the butter to be studied with a certain number of times its weight of alcohol of 90 deg., and for greater security he operated at once and in the same conditions on isolated butter and on butter kept in darkness and sheltered from the air. Experiment gave the following results with a weight of alcohol equal to five times that of butter:

Initial butter, 0.53 per cent of dissolved matter.
Sample No. 1, 2.43 per cent of dissolved matter.
Sample No. 2, 2.20 per cent of dissolved matter.
Sample No. 3, 3.45 per cent of dissolved matter.

The fatty matter becomes more soluble in the alcohol after isolation.

In another experiment the butter was treated with about thirty times its weight of alcohol. Samples were left in darkness, in semi-darkness and in the sun. Alcohol of 90 deg. dissolved at a temperature of 15 deg. the following samples:

Initial butter	0.53
Butter kept in darkness	0.56
Butter kept in semi-darkness	0.57
Butter kept in the sun	1.35

The proportion of matter soluble in alcohol increases a little by contact with the air, a good deal from action of the sun, and still more if the butter has been rendered alkaline by any circumstance. This increase may proceed from the formation of a resin, but we are not justified in referring it to this cause before assuring ourselves that known phenomena cannot explain the fact.

These phenomena are the saponification of butter and the production of formic acid. Saponification yields fatty acids which are more soluble in alcohol than their glycerides, but so long as the action of microbes is avoided, this saponification is of slight importance, scarcely exceeding one per cent of the fatty matter. It cannot therefore furnish an explanation. We recall, too, that Chevreul noticed that the matters dissolved by alcohol contained neither glycerine nor free acids. The production of formic acid ought to be studied more closely. It is accompanied with an increase of 1.3 to 1.5 per cent in the weight of the butter. From this increase the formula

$$C_{2}n\ H_{2}n\ O_{4} + 4(n-1)O = n\ C_{2}\ H_{2}\ O_{4}$$

would allow of deducing the proportion of formic acid produced, if the value of *n* were known; that is to say, the nature of the fatty acid undergoing oxidation.

It is certain that olein and oleic acid absorb oxygen and increase the weight. The case is the same with butyric, caproic and caprylic acids, and their combinations with glycerine.

M. Duclaux concludes that oxidation may bear unequally on the different constituents of butter, but has an influence on all of them. What he regards as unexplained is the fact that the oxidation does not exceed 1.5 per cent, a very low figure, when it is remembered that if butyric acid does not require, in order to become formic acid, much more than its weight in oxygen, the fatty acids, properly so called require more than three times their weight. It is therefore only a very slight proportion of the constituents of the butter that is affected by the oxidation, but remarking that in the equation written above the weight of the formic acid is nearly equal to 3-2 of the oxygen absorbed, it is seen that the weight of formic acid, when the oxidation is at the maximum and amounts to 1.3 per cent, would represent about two per cent of the weight of the butter.

This is a figure sufficiently in accord with those cited above. In accepting it as exact, we can explain the augmentations of solubility of butters kept in the sun, either alone or in presence of magnesia, but not the augmentation of the solubility of butter isolated in presence of ammonium carbonate. If therefore there is a formation of resin, it is especially in this butter that it is to be sought, or in the fats of cheese which grow old in the alkaline state. Such cheese becomes black and takes on a color similar to that which has been noticed in our fatty matter, while it remained alkaline. The persistent alkalinity of cheese bears upon this result, and we can produce the same effect in butters by submitting them to the action of microbes in such a way as to preserve the alkaline state.—Translated from Le Phosphate.

NEW OVEN HEATED BY THE OXYHYDROGEN BLOWPIPE AND THE CIRCUMSTANCES THAT LED TO ITS CONSTRUCTION.*

WHEN I attempted to reproduce the diamond, I discovered that the research must be extended, and embrace the examination of the different varieties of carbon.

The subject, thus generalized, included an interesting study, that of the solubility of carbon in metals in a state of fusion. As a certain number of these metals had a very high fusing point, I undertook experiments by means of the oxyhydrogen blowpipe.

This apparatus has been employed by chemists for more than a century. Lavoisier made use in 1782 of the property of oxygen to support combustion, causing it to act on carbureted gases produced by an enamelers' lamp.

After liquefying, by means of this process, a large number of substances previously regarded as refractory, Lavoisier was able to obtain the fusion of native platinum and the volatilization of gold.

To secure regularity and longer duration for his experiments, he procured the construction of hydrastatic bellows. Meusnier simplified this apparatus in Lavoisier's laboratory and made use of it in pursuing numerous researches on the fusion of substances.

The first idea of the oxyhydrogen blowpipe appears in Lavoisier's works, and he gives credit for it to a suggestion made to him by President De Saron.

"President De Saron has communicated to me a very ingenious idea for operating on substances that cannot be put in contact with charcoal. It consists in bring' [illegible] of which shall furnish the *vital air*, the other *inflammable air*. Thus a very white, luminous and hot flame is produced, with which iron is easily melted, but with which it has not been possible for me to fuse platinum. This method of operating is so convenient and so free from every objection, that I would prefer it to any other if it afforded sufficient heat. Perhaps, by contriving an apparatus, in which the vital air may surround the inflammable air on all sides in such a way that the latter may burn in an atmosphere of vital air, a greater effect may be produced."

The idea of the oxyhydrogen blowpipe, thus shadowed forth, was realized, for the first time by an American chemist.

Robert Hare, professor in the University of Pennsylvania, constructed in 1801, for obtaining an elevated temperature, the first gas blowpipe in which hydrogen was burned regularly in an atmosphere of ogygen. This first blowpipe effected the complete separation of each gas in a special tube. The oxygen and hydrogen were not mingled until issuing from the blowpipe. Hare describes in his treatise on chemistry a great number of interesting experiments made with the apparatus. He thus secured the fusion of platinum, of alumina and of silex.

"In the year 1801," he says, "by the invention of the hydro-oxygen or compound blowpipe, I was enabled to fuse several of the pure earths, which had previously been deemed infusible; and likewise, not only to fuse, but to volatilize pure platinum. Subsequently, my friend Prof. Silliman, by a more extended use of the instrument, fused a great number of substances, insusceptible of fusion by the common blowpipe."

Later, in 1816, Daniel Clarke, professor in the University of Cambridge, England, after taking the advice of Sir Humphry Davy, compressed in the receiver of the Neumann blowpipe the detonating mixture of hydrogen and oxygen necessary for the formation of water. In these conditions, the mixture of the two gases is intimate, and their combustion yields much more heat. Clarke's experiments were brilliant and he was able to fuse a small quantity of lime and to volatilize gold.

But these experiments were always attended with danger, and in consequence of several accidents, chemists soon returned to the idea of separating the two gases.

In early experiments the matter to be fused was arranged on a piece of graphite. Later, it was supported by platinum wires in such a way that the loss of heat by radiation was almost at the maximum.

Deville and Rebray then conceived the idea of inclosing the blowpipe for oxygen and hydrogen in an oven of quick lime. This was the starting point of their valuable researches on the ores of platinum, and of a complete transformation, or rather of the veritable creation, of the industry in these ores.

In effecting the fusion of platinum, Deville and Debray had, by heating a small reverberatory furnace, obtained a temperature of about 1,800 deg. C. But platinum is an inoxidizable metal which may be preserved without harm in the liquid state in an oxidizing atmosphere. On the contrary, the metals capable of fixing oxygen are burned when the attempt is made to fuse them in this apparatus.

I have therefore given to this little furnace a form which I will describe.

The crucible containing the metal is placed in the middle of a cylindrical inclosure. Over it is a dome having an opening for the passage of the products of combustion. The cylinder and the dome rest on a disk through the middle of which passes the point of the blowpipe with easy friction. In order that the hot gases may surround the crucible this is supported by the edges of three small prisms. The whole is of quick lime. If care be taken to select a lime somewhat hydraulic, as that of the green bunk of the Paris basin employed by Deville and Debray, the crucible and the cylinder may be worked in the lathe with facility and the disk and the dome cut out with a knife.

The apparatus measures about twelve centimeters in exterior diameter and fourteen centimeters in height. The lime crucible has a diameter of three and a half centimeters, a height of four centimeters and a thickness of from two to three millimeters.

In making use of this arrangement, the crucible is heated at the lower part, and the flame of the blowpipe afterward surrounds it completely. This is the advantage that this little oven offers over the crucible oven of Deville and Debray, which they utilized in their fusion of osmium. I have always employed in my experiments the blowpipe of these investigations.

The oxygen was furnished by the gas companies and could not have contained more than two or three per cent of nitrogen. The compressed gas, coming from the steel cylinder, was conveyed to an expander. The hydrogen was prepared from zinc and sulphuric acid in the Deville continuous apparatus, dried by its passage through a flash of eight to ten liters, filled with large pieces of calcium chloride, and conducted directly to the blowpipe.

At the outset of these researches, I noticed that certain metals, iron in particular, furnished, as soon as they were melted, oxides which combined with the lime and produced double compounds readily fusible. The crucible was perforated, and the fused metal fell into the oven. I then molded under strong pressure small crucibles of graphite, which were fitted loosely in the lime crucible, so that the charcoal was not in contact with the flame of the blowpipe. It is indeed impossible to leave graphite in the oven without a covering of lime; otherwise it burns and soon disappears.

With the arrangement described, I have been able to bring certain metals to the temperature of 1,800 deg. in presence of carbon. When the furnace is well arranged, the fusing experiments may continue readily for an hour. And the same oven of lime will serve for several days, if care be taken, when it is not in use, to shelter it from the moisture of the air and to strengthen it with a few coils of iron wire.

The experiments that I have conducted with this apparatus have lasted for two years. They have often furnished contradictory results. This is not surprising. In the conditions of the experiments, the fusion of the metal, in presence of an excess of carbon, is produced in an atmosphere rich in steam, that is, oxidizing. On the other hand, the combustion of the coal

* [illegible] ale et

and the carbon vapor furnishes a reducing medium. So, if a constant temperature is not reached, it is impossible to obtain an equilibrium between these reactions. Besides, complete reactions do not occur under these conditions, and the results vary in different experiments.

But the attempts I have pursued with this apparatus have not been fruitless. As often happens, when a subject is studied methodically, the experiments have taught how to manage elevated temperatures, and how carbon behaves in presence of certain metals at 1,800 deg., and when I have had occasion to use my electric furnace, these initial attempts have prepared the way and allowed of advancing much more rapidly.

I have, therefore, deemed it suitable to make known this simple model of a blowpipe oven, which in certain cases may be of service to experimenters.

PRODUCTION THROUGH THE HUMAN BODY OF SECONDARY X-RAYS AND RADIOGRAPHS.*

As is well known, it is difficult to obtain with a good contrast radiographs of very thick regions. These negatives, even the best, appear always on development more or less obscure. This cannot be explained by the pure and simple absorption of rays.

Some have thought the cause of the obscurity was a diffusion of the X-rays through the air, but this diffusion is infinite, and, in the medico-surgical applications of these rays, it can scarcely be considered the cause of this lack of clearness.

The obscuration arises from the diffusion of the rays through the supports, regulating apparatus, walls of the room, tissues, body of the radiographic subject, and sometimes through the body of the operator himself. The interpretation of the following experiment leads naturally to this conclusion.

I placed a Chabaud tube above a large lead plate, whose surface was 1 millimeter square and thickness 2 millimeters. This plate was pierced with a rectangular opening 4 centimeters by 10 centimeters, allowing the full entrance of a pencil of X-rays. In order to have a region of the space well sheltered from the rays traversing the lead sheet, I placed on the latter a steel plate 15 millimeters in thickness, with one of its sides coincident with one of the edges of the opening which allowed the passage of the rays. In the space beneath this plate, and thus withdrawn from the action of the X-rays directly emitted by the source, was placed a screen fluorescent with barium platino-cyanide, and it was proved that it is impossible to obtain an outline of the hand or of a metallic object placed against the screen. If an assistant then covered with his hand the opening through which the pencil of rays emerges, or further if he placed his hand or any object whatever in the pencil of rays, an outline of the objects would appear. It is therefore sufficient to place the hand, a bit of tissue, of wood, a thin handkerchief, even a sheet of paper, in the path traversed by the rays and in a region of the space which is visible from the position of the screen, to illuminate the latter, and this whatever may be the position given to the object. There is then produced, not only on the surface, but throughout the entire thickness of substances, secondary X-rays, similar to those whose formation and diffusion over the surface of metals M. Sagnac has studied.

This formation is far from being negligible in radiographic practice, and the photographs which I have the honor to present, were obtained in two minutes of pose under the action of rays diffused through the human body.

These negatives were taken by placing in the position where the fluorescent screen was previously situated, a photographic plate surrounded with black paper and half of which was also wrapped in a sheet of tin 2 millimeters in thickness. A pose of two minutes was made by placing before the half of the plate not covered with metal, a portemonnaie in one case, in another the two fingers of the hand holding a metal disk, and this after carefully removing all the objects placed in the pencil of the X-rays. Then the sheet of tin which was displaced in order to shelter the portion of the plate subject to the preceding pose. There was a new pose of two minutes, while the assistant covered with his hand the opening allowing the passage of the rays.

These negatives show, on the half of the plate corresponding to the first pose, an image *scarcely visible* of the objects, probably due to the diffusion of the rays on the ground. On the other half the plate, however, is a strong image, produced by the rays emitted through the hand placed in the line of the X-rays. This image is expanded, because the source of the rays represents a large volume.

Thus the radiographer, at the instant of taking the photograph, should consider all surrounding objects as fluorescent with invisible radiations, which impress the plate in a diffuse manner and tend to fog the image desired.

In radiography of a rather thick region, these secondary rays would not be very injurious, because their action on the plate would be slower than that of the X-rays transmitted directly through the tissues to form the bony silhouette. This is not the case with the radiographs taken with very stout adults; the bed on which the subject rests, the cushions, etc., may send directly on the plate some secondary rays, which not being absorbed by the body of the subject, would have on the plate an action of the same kind as those of X-rays traversing the flesh.

It has been proposed by those believing the obscuration was due to diffusion of X-rays through the air to have a metallic cone extend from the small base of the tube to the subject. The action of this apparatus is bad, because if it protects the plate from the secondary rays emitted by the surrounding objects, it presents itself a large surface for the production of secondary rays.

A much preferable process consists in inclosing the subject in a sheet of lead which exactly follows its outlines.

In any case the flourescopic and radiographic apparatus should be reduced as much as possible, to avoid the formation of secondary rays. To suppress the rays diffused by the sides of the tube, a thick metallic diaphragm should be placed before it. In these conditions, the slit in the diaphragm alone sends the secondary rays, which are very slightly injurious, considering their direction. It is well, in order to have a sufficient field, to give to a tube a very narrow and elongated cylindrical form.

A diffusion impossible to avoid is that of the tissues of the subject to be radiographed. This may be always diminished by means of thick metallic diaphragms, which only admit the field of rays necessary to form the radiographic silhouette desired.

* From the French of M. T. Guilloz, in the Bulletin de la Société Française de Photographie.

PRECIOUS STONES IN THE UNITED STATES IN 1901.

By GEORGE F. KUNZ in the Engineering and Mining Journal.

THERE were more precious stones and pearls imported into the United States, more sold, and more precious stones found in the United States during 1901 than any previous year in our history.

In summing up the leading features of the precious-stone industry of the United States for the year 1901, the following points are the most notable: (1) the continued output of fine blue sapphires in Montana, in Fergus County, and of fancy-colored ones in Granite County; (2) the systematic working of the beryl locality in Mitchell County, North Carolina; (3) an increased production of turquoise from Nevada, and from the New Mexican mines in Grant and Santa Fe Counties, together with (4) the large sale of the ornamental stone known as "turquoise matrix," wherein the gem and the gangue-rock are cut together, from all these turquoise mines; (5) a similar cutting of rock and gem, from the emerald locality in western North Carolina, under the name of "emerald matrix;" (6) the mining of the beautiful purple-pink garnets, now known as rhodolite, in Macon County, North Carolina; and (7) the discovery of remarkable colored tourmalines at a new locality in San Diego County, California. To these points may be added, commercially, large importations of diamonds and of Australian opals in the rough and their cutting in this country; and, with regard to public facilities for study, the presentation to the American Museum of Natural History, New York, by Mr. J. Pierpont Morman, of the extensive Tiffany collection of American gems and precious stones, from the Paris Exposition of 1900, and of the splendid cabinet of minerals gathered by Mr. Clarence S. Bement, of Philadelphia, both of which collections contained many specimens of gem-minerals of great beauty, the latter only in their natural state.

DIAMONDS.

The discoveries reported during the last year are as follows:

In India a 4¾ carat octahedral diamond was found by a farmer in panning for gold on a tributary of Gold Creek, in Morgan County. Prof. W. S. Blatchley, State Geologist, informs the writer that several other diamonds have been reported from the same region. These finds resemble those of 1890 on Plum Creek, Wisconsin. They are glacial evidently of the first ice invasion.

In the Southern States are reported a diamond of 1 13-16 carats found in the vicinity of Knoxville, Tennessee, and another of 4¼ carats in Shelby County, Alabama, making three new finds for the year 1901.

SAPPHIRE-RUBY.

Montana.—The Fergus County sapphire mines at Yogo have been actively and successfully worked. The gems occur in a vertical "lead," or "vein," of clay, inclosed between walls of rock, i. e., in a decomposed igneous dike. This material is taken out and washed, and the stones are then sorted. The company operating the mines has worked down some 50 or 60 feet, but exploration to a depth of 200 feet shows the same occurrence of sapphires. Different portions along the dike, however, vary widely in richness.

It is stated that quantities of corundum besides the gem variety are obtained, and that large amounts of it of no present value until railroad transportation is available, are lying on the dumps. The most important gem yet found here was a very deep blue fine stone of over 3½ carats.

The Granite County deposits, at Rock Creek, were worked somewhat during 1900, and an attempt was made to trace the gems to their original source in the rock, with what success has not been reported. A large number of gems were obtained from the beds and were cut at Helena. The proportion of red ones—rubies—was greater than heretofore, but none had the deep color of true oriental ruby. They were of light shades of red, beautiful and extremely brilliant, but not so dark as desired. At least sixty occurrences of rubies were located on several miles of gulches, in nearly every instance associated with gold. All the water used in washing them was the result of melted snow and ice of the previous winter.

EMERALD.

The emerald and hiddenite mine at Stony Point, Alexander County, North Carolina, is now relieved of the litigation which has hampered it for several years past, during which time nothing has been done there, or at least no discoveries have been reported. Few gem emeralds were found here; but remarkable crystals, finely formed and richly colored, and as much as 10 inches long, translucent to semi-opaque, were taken out about twenty years ago when the mine was first opened.

Emerald Matrix.—A novel and attractive stone has recently been brought forward under the name of "emerald matrix." The emerald deposit at Big Crabtree Mountain, Mitchell County, North Carolina, has been lately worked by a New York Company, and, although few transparent gems have yet been obtained, a beautiful ornamental stone has been developed. The crystals vary from one-eighth of an inch to 1¼ inches in diameter, and are rarely over 1 inch in length. They are not transparent, but have rather a fine emerald color, penetrating narrow veins of quartz and feldspar in an irregular manner. This green and white mixture is very pleasing and as the feldspar has a hardness of 6.5, the quartz of 7, and the emerald of about 8, the whole can be cut and polished together. Pieces are cut *en cabochon*, showing sections of one or more emerald crystals on the top and sides of the polished stone.

Beryl Crystals.—Very large opaque crystals of beryl, like those from Acworth, New Hampshire, and smaller crystals of gem quality, have been found near Blandford, Massachusetts. The large crystals occur in ledges of white quartz rock, and are quite abundant and of great size. The small ones are found in boulders and stone fences; their source is not yet known, but must lie to the north, in the line of glacial transportation. Some of the crystals are reported as highly valuable for gem purposes.

TOURMALINE.

Recent discoveries in Southern California have revealed a locality of colored tourmalines that bids fair to become famous. A ledge of quartz and lepidolite, at an altitude of nearly a mile, on Mesa Grande mountain, San Diego County, is found to be full of tourmalines of great variety. As compared with the well-known locality of pink tourmalines in lepidolite at Palo, Cal., this new occurrence differs in presenting large and separate crystals in both lepidolite and quartz, many being translucent or even transparent, and with perfect termination. Rubellite is the prevailing variety; but all the colors occur, sometimes several in one crystal—both in transverse sections, as at the Maine and Connecticut localities, and in concentric zones, as often in Brazil. Besides these there are some large and perfectly colorless achroites, and some choice yellow specimens. Frequently rubellite or other colored crystals have a thin dark green or nearly black outer shell or coating, characteristic of this locality. Many gems have already been cut; and as specimens, the crystals are magnificent. A number of single rubellites, only partially perfect, weighing up to 70 carats each, and occasional yellow, green, and white gems, have also been found here.

AGATIZED WOOD.

The celebrated "Petrified Forest" near Holbrook, Ariz., has been brought within easier access for tourists by the establishment of the new railroad station named Adamana, whence it can be reached by a drive of 6 miles, although the most remarkable portions lie several miles farther southward. Most travelers visit only this nearer part, and the other sections are less known. Dr. Lester F. Ward of Washington, in a report to the Director of the United States Geological Survey, fully describes the entire area. Dr. Ward visited the region in November, 1900, under directions from the General Land Office and the Smithsonian Institution, with a view to securing some such action for its protection as that advocated by the Arizona legislature several years ago. He strongly recommends the withdrawal of the area of the petrified forest from private entry and advises its reservation as a national park.

The locating of a nearer station, with easier access to these unique localities, renders more important than ever some form of Government oversight of these natural treasures of priceless interest. It is a place that interests tourists from all lands as well as the geologist. The original source of the agatized wood, the beds in which the trees grew, must be sought higher up, and perhaps at some distance, in strata previously eroded to form the sandstones into which the trunks were borne. It was originally an early Triassic land at an elevation of fully 500 feet, which was invaded and covered up by Mesozoic seas and not raised until the great post-Cretaceous elevations began that have lifted this entire region a mile above the present sea level.

A magnificent display of this agatized wood (the richest American ornamental stone) cut and polished sections of trunks, of the richest colors, and various ornamental articles made therefrom, was shown at the Pan-American Exposition at Buffalo, as also at the Paris Exposition in 1900. At the former there were three separate exhibits, one in the Mines building, one in the Manufactures and Arts building, and one in a small pavilion apart. These exhibits were made by the Drake Company of Sioux Falls, N. Dak., where the great cutting and polishing works for this hard material are operated by water power, and where work of this kind is done that is not surpassed anywhere in the world, not even in the great government lapidary works of Russia.

TURQUOISE.

Turquoise was actively mined for in the past year. A feature of the American turquoise companies is that many of them give a guarantee that if a gem changes in color before the expiration of six months after its purchase from a retail jeweler they will replace the stone by a new gem of unchanged color. Several companies claim that these gems never change, which, if always so, would seem remarkable for a mineral so long known as of a somewhat unstable character. This guarantee, however, is a great advantage over the ancient method of the Persian selling his gems and departing for lands unknown the day of the sale. The various companies protect themselves by engraving a trademark on the backs of the cut stones, with an A for American, an O for Azure, a + for American Turquoise and Copper, a T for Toltec, etc. There are at least six companies actively engaged in mining this beautiful stone at the present, with companies on the increase. It is a question of time how much output the market will stand.

THE CHAH OF THE CZAR.

A DIAMOND of large value is preserved at Moscow, which became the property of the Czar under the most dramatic circumstances. It has the form of an irregular prism, of the size and nearly the length of the finger and bears the name of *chah*.

This diamond belonged formerly to the Sophi. It was one of two enormous diamonds, which adorned the throne of Nadir-Chah and was called by the Persians the "Moon of the Mountains." When Nadir was assassinated, his treasures were pillaged, and his precious stones were divided between some soldiers, who concealed them.

An Armenian, named Shafras, dwelt at this time with his brothers, in the town of Bassora. One day, an Afghan came to him and offered for sale a large diamond, with a hundred other pieces of less value, the whole for a very modest sum. Shafras, surprised at this offer, begged the Afgan to call again, saying that

he had not the necessary funds on hand to purchase them. The diamond seller, apparently suspecting the good faith of Shafras, secretly quitted Bassora, and despite all the inquiries of the three brothers, could not be discovered.

Some years later, the eldest met him by chance at Bagdad, just as he had sold all his precious stones. The seller was induced to point out the dwelling of the purchaser, who was a Jew, and who refused an offer of double the sum he had paid. Meanwhile, the two younger brothers had joined the other and the three conspired and killed the Jew. The following day they poisoned the Afghan whom they had invited to take some sherbet with them. The two bodies, inclosed in a sack, were thrown into the Euphrates.

Soon a dispute arose among the three brothers over the division of the stones, and the eldest got rid of his two brothers in a similar manner. He then fled to Constantinople and passed a little time afterward into Holland.

There he made known his riches and offered them to the different courts of Europe. The news reached Cathrine II., who offered to treat for the "Moon of the Mountains" alone. He was invited to Russia and put in communication with the court jeweler. The conditions were: Letters of nobility, an annuity of ten thousand rubles, five hundred thousand rubles payable in tenths from year to year.

Shafras demanded six hundred thousand rubles cash. Count Pancin, then minister, delayed the trade for a long time and launched the Armenian in a style of life which obliged him to contract considerable debts, and when he knew that he no longer had a sou wherewith to pay, he abruptly broke off negotiations. Shafras, according to the laws of the country, could not leave the empire, or even the town, without paying his debts. His situation was embarrassing.

The jeweler of the court prepared to profit by this distress; the diamond was about to fall into his hands for only about a quarter of its value.

The Armenian came to understand the trap into which the minister had drawn him, and he secretly sold to his compatriots some inferior stones, paid his debts and suddenly disappeared.

It was after ten years that he was again discovered in Astrakhan, arranging to pass into Georgia and from there into Turkey. New offers were made, which he only accepted on the condition that the business should be transacted in Smyrna, where his treasures were deposited. This was a wise precaution. Cathrine accepted, granted him letters of nobility, six hundred thousand silver rubles, and more than seventy thousand rubles in assignats.

Shafras, unable to return to his native country, settled in Astrakhan and married there. Twenty years later one of his sons-in-law poisoned him with mushrooms.

The immense fortune realized by the assassin was dissipated in a few years by his children. Several of his grandchildren are still living at Astrakhan in abject poverty.—Translated from Le Diamant.

LONDON FOGS.

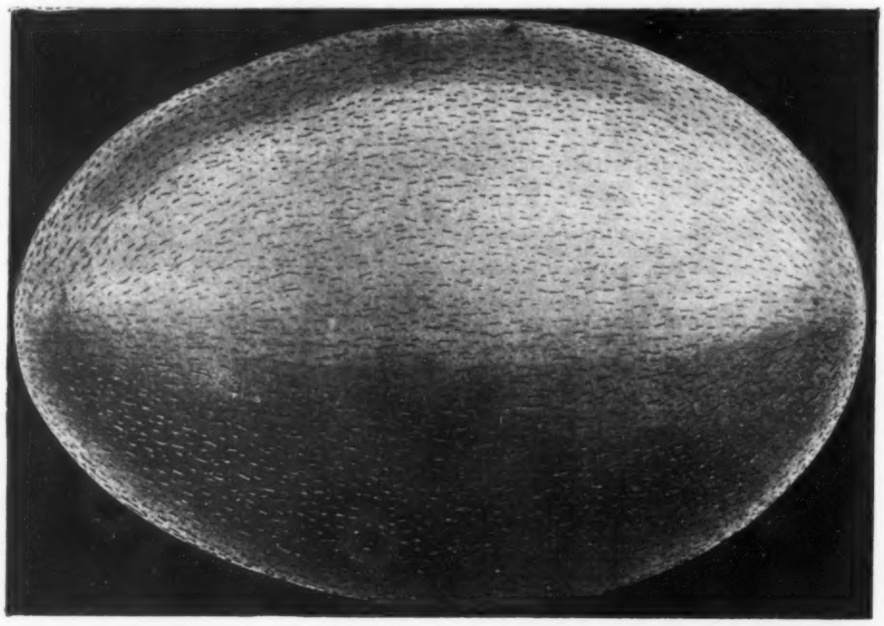
In the report of The Lancet Special Analytical Sanitary Commission on Smoke Prevention and Perfect Combustion which was published in The Lancet of November 25, 1893, appears the following sentence: "If this enormous increase (of gas) can be successfully grappled with at a single day's notice and maintained for several days (it is often only a few hours' notice, for there are no means of ascertaining the precise moment when fog appears or when the temperature will suddenly fall), it is evident that even the existing plant, both manufacturing and distributing, is equal to the increasing requirements necessitated by the application of gas for purposes other than those of lighting." Those remarks were made in connection with the proposal to substitute gas for coal for domestic heating purposes. The report referred to related to an inquiry undertaken to show that the introduction of gas as a general heating agent was not only practicable, but that if a system of gas heating could be universally adopted one of the worst factors concerned in the production of smoke and fog in the metropolis would be overcome. In other words, the inquiry was undertaken in the interests of public health. Since the publication of this report it just happens that the severity and frequency of London fogs have steadily diminished, according to the meteorological authorities, who are inclined to attribute this fact to the increasing use of gas for heating purposes. Apparently the public health aspect of the matter has never appealed to the public authorities sufficiently to arouse them into an active state of inquiry directed to the suppression of the smoke evil, but an inquiry is now promised which has been prompted, oddly enough, by the representations of electric and gas lighting companies. It might be thought that it was congenial to the interests of the directors and shareholders of public lighting companies that fog should remain. The demand for artificial light is greater than ever, chiefly on account of the enormous expansion of the inhabited areas in and around the metropolis. The supplying companies can cope readily enough with this demand in normal times, but on the advent of sudden darkness, as by fog, of which they have no means of obtaining warning, their resources, as many of our readers to their discomfort and inconvenience know too well, are strained to the utmost. And this fact has led the companies concerned to appeal to the Meteorological Office for a system by which special forecasts or warnings of the approach of fogs could be issued to them. The Meteorological Office has communicated with the London County Council, and the General Purposes Committee have practically agreed to co-operate with the meteorological authorities. The subject of inquiry will be the occurrence and distribution of fogs in the London district and their relation to other atmospheric and local conditions. It is now proposed: "(1) That a gentleman of suitable scientific qualifications be engaged by the Meteorological Council for a limited period to formulate instructions and a scheme of observations and to conduct the investigation; (2) that the observations be taken at the various fire brigade stations and by men of the fire brigade, and also if it can be so arranged at other institutions of the London County Council; (3) that the returns be sent from the various stations and from any other institutions selected directly to the Meteorological Office; (4) that the Meteorological Council do arrange with the police authorities for observations to be taken at selected positions outside the County of London; (5) that all responsibility as to the conduct of the investigation and any published results of such investigation do rest with the Meteorological Council; (6) that a copy of the complete returns and twelve copies of a report thereon by the Meteorological Council be supplied to the London County Council; and that the London County Council do contribute a sum of £250 for the investigation." It is reported that these proposals, which were accepted by the London County Council at its weekly meeting held on October 23, represent a satisfactory and practical arrangement, and that the Fire Brigade Committee will raise no objection, and that the chief officer of the fire brigade is prepared to conduct the work also as far as the brigade is concerned, provided that the instruments intended to be used for the observations are the ordinary hygrometric instruments such as are used in the Royal Navy. The results will be looked forward to with interest, and everybody will wish the inquiry to be brought to a successful issue, so that our electric lighting and gas companies need not be worried to meet the demands for extra light necessitated by the onset of fog, and that some means will be found by which the formation of black stifling fogs may be to some extent prevented. Mists are inevitable in that climate in the winter, but it should be an offense everywhere to blacken them with smoke. Artificial light is a necessity, but it is as nothing compared with the necessity of pure air and an undarkened day.

THE MOST VALUABLE EGG IN THE WORLD.

New Zealand, the home of the exinct moa, is a most interesting country. Imagine a land about twice as large as Italy with only four native species of mammals, without snakes, turtles and frogs, a land full of mountains which are 12,000 feet high or higher, and whose tops are covered with perpetual snow and ice, and wonderful volcanoes and geysers which are constantly changing through the action of subterranean forces. Although less than half as large as Madagascar, its fauna is quite as rich in remarkable specimens, among which were, a hundred years or more ago, the great dinornithidæ or moas, skeletons of which have been found in an excellent state of preservation in many of the so-called "hunting grounds;" and even reddish-brown feathers have been discovered, which seem to establish the close relationship of the extinct moa and the living emu.

In January, 1899, while men were dredging for gold in the Molyneux River near Cromwell on South Island, a portion of the high bank was removed and a deposit of very fine, powdery river sand was exposed, and here an unbroken egg was discovered, a much more valuable treasure than the yellow metal that was being sought. By comparison with fragments of shells found it is evident that the surface of this otherwise uninjured egg has been badly rubbed. The color of the eggshell is a light yellowish brown, and it is characteristically marked by pores arranged lengthwise of the egg in irregular dots and dashes. When shaken the egg rattles, showing that the contents have dried or shriveled up. Prof. W. B. Benham, Director of the Otago University Museum (to whom the writer of the article is greatly indebted for valuable material placed at his disposal) is of the opinion that this egg belongs to the species *Emeus* (*Euryapteryx*) *crassus*, because this appears to have been the most numerous, in fact, almost the only species in the district where the egg was found; and his views seems to be sustained by the fact that many fragments of eggshells which have been found in this district belong to the same species.

Our engraving shows this priceless egg. Apparently it is smaller than an ostrich egg, but actual demonstration has shown it to be larger. Careful casts were made of the egg, from which several artificial eggs were most accurately produced, so that a good idea could be obtained of the appearance of the nest of one of these gigantic birds, and then it was found that ten of them covered a larger space than was required for twenty eggs of the African ostrich. One moa egg would contain as much as two ostrich eggs. This illusion as to the size of the two eggs is caused by the difference in shape. It is thought that the extinction of the moas was probably due to the destruction of their eggs by the native Maoris.—For the above data and the accompanying engraving we are indebted to the Illustrirte Zeitung.



THE MOA EGG IN THE OTAGO UNIVERSITY MUSEUM AT DUNEDIN, NEW ZEALAND.

CULTIVATION OF THE OLIVE IN ALGERIA.*

In Algeria the olive is adapted to all soils. It resists alike the highest and the lowest extremes of temperature. If its growth is slow on the hillsides, it is vigorous on irrigated lands, where it begins to bear to some extent in two or three years. During the summer period watering once a month is sufficient, at the rate of two cubic meters per hectare, or about the fortieth part of the water necessary for grass lands.

Until the olive is in bearing there is no difficulty in cultivating cereals or forage crops between the rows, which ought not to be less than twelve meters apart, but as soon as the tree commences to bear, it is advantageous to give it, in the spring or summer, three or four light dressings.

When it is not possible to bring irrigating water in summer to an olive yard, situated on the side of a hill, the winter waters may be made to answer, if suitably managed.

The most economical method is to divide the plantations into rectangles, of which the long sides are horizontal. These are made narrower in proportion as the incline is the steeper. On the lower side, these rectangles are bounded by ridges 40 to 50 centimeters high. This arrangement forms a number of small basins, one higher than another, emptying into each other. The uppermost of the basins is supplied by means of pipes running to the uncultivated parts of the acclivity, with all the water needed. During storms, the water, instead of flowing to the river, is collected in these terraced basins, forming a series of small lakes, there being no outlet except to the subsoil, which is soaked thoroughly.

In the regions where this system of winter irrigation prevails, it rains less than at Orleansville, yet the trees are enriched, and have become quite valuable, yielding regular and abundant crops.

The planting of the olive in the plain is inexpensive. It is confined to the purchase of the plants and the making of holes of 1 cubic meter, 12 meters apart. In the dry section, the tree being planted at the bottom of the hole, which is filled up as it grows, is thus protected from the wind and sun. It also secures at the start a very deep network of roots, capable of drawing moisture from the subsoil and of resisting drouth.

The olive is not only favored in surviving in the moist lands, in growing where there is so little rain that no other fruit tree will thrive without summer water, in resisting the strongest heats, and in costing but little for planting and maintenance, but it has the immense advantage of covering considerable stretches of otherwise unproductive lands on account of its slight necessities, and of having an unlimited outlet for its products. For three months in the autumn it requires considerable hand work, but the gathering does not exact skill, and is not arduous. It is performed by the feeblest and poorest of the people, and comes just when their needs are the greatest.

The best example of the transformation of a soil, comparable to that of the hillsides of the Valley of the Cheliff, for olive cultivation, is that of the southern part of the Tunisian Sahel. At Sousse the soil is arid and clayey; it rains less than at Orleansville, and irrigation is not in use. Four millions of olive trees, yielding one year with another, fifteen millions of liters of oil, selling for about twelve millions of francs (not including the black olives which serve as a fertilizer and for fuel), have converted a desert into a flourishing country.

In the regency the poorest part of the population camp out under the olive trees during the harvest. Their compensation is estimated at about four millions of francs. When the harvest is ended, the flocks and herds are let in and eat the leaves of the broken

* From the French of M. Marès.

branches. The wood is cut, bound in fagots, and sold for domestic use.

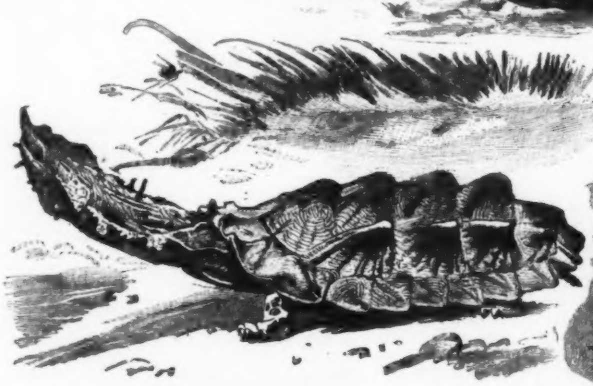
In Oran (Algeria) the cultivation of the olive improves every year, but two things interfere with the progress that might be expected. The young trees are dear, costing more than the planting itself. On the other hand, no investigation has been made of the different varieties. In the valley of the Cheliff, oil olives have been planted for table olives, and *vice versa*. This has been an obstacle to the development of the industry. The formation of olive nurseries, designed for the increase and study of these trees, is an undertaking of imperious necessity.

RARE ANIMALS AT THE ZOOLOGICAL GARDEN IN DRESDEN.

Two new species of dogs have been added in the Zoological Garden in Dresden lately, viz., the Siamese

BRAZILIAN DEERHOUNDS.

SIAMESE DOGS.



FRINGE TURTLE.

ASORTA GOATS.

dog and the Brazilian deerhound. It was the King of Siam who sent the Siamese dogs to Vienna, but their ferocity and exceedingly loud barking made them so unbearable that they were transferred to the Dresden Zoo. Their general aspect is like that of the wild Australian dingo (*Canis dingo*), with the exception that the latter is of a yellowish red, while the Siam dog is of a dark brown color. His head is short, thick and flat at the top, sloping down to the point of the nose. Eyes brown, pointed ears, bent forward, and short neck. The breast low and broad, back short and straight. The tail is short, strong, bushy and erect. Hair full, straight and short. In their native land they must be excellent watchdogs, as the least noise makes them wild with rage and quarrelsome among themselves. They even bite each other, so that they frequently have to be separated. For this reason it is impossible to raise them away from their own country.

The deerhound comes from Brazil and is very tame. In his country he serves as a hunting dog. He looks much like a bulldog, with the exception that he is much more graceful. The head is long and pointed toward the nose, eyes brown, ears long and thin, which he raises when excited, the neck long and supple, back slightly curved in, breast narrow and low. The hair on the tail is longer and thicker than on the body. The fore legs are very straight, while the hind legs show highly developed muscles. The lower part of the thigh is long and slanting, with well-developed hocks. Color yellowish red, with white breast. While the Siam dogs have not multiplied here, the deerhound has.

One of the ugliest and most remarkable turtles, a Matamata, was sent to the Dresden Zoo by the photographer, Huebner, from Manaos on the lower Rio Negro, not far from where that river flows into the Amazon. The upper sides of this animal are brown with irregular cone-shaped and ribbed stripes of a darker shade. The lower side is of a greenish yellow with long black stripes on the throat. The head is crushed on the top and ends in a narrow trunk. The nose is split in two. From the nose and neck large round moss-like lobes are pending. The matamata is two meters long when full grown and is one of the ugliest but also one of the most interesting animals known. A very disagreeable smell saves her from being persecuted by other animals. The Caribbean Indian of the north of South America hunts this animal in spite of its awful smell and eats its meat. The matamata can only be found in Guiana and the north of Brazil, especially near the streams Essequibo and the middle Amazon River. When captured she refuses all food, and although all reptiles live long without it, she perishes after a while.

The beautiful goats at the Zoo in Dresden are not only to look at, but are meant to serve the farmer as examples. The crossing of the ibex and domestic goat and their offspring in one-fourth, one-eighth and one-sixteenth grade (blood), also the Swiss milch goat from the Simplon (where they keep herds of 150 Circassian domestic goat, the wild Greek goat, the Angora goat which is raised in California for its hair and which is now being introduced in German Southwest Africa, also a newly imported goat from East Africa presented by Joseph Menger, the African explorer. These goats were intended for food for the wild animals on the road, but they proved so interesting and stately that they were saved. Their horns are very much like those of the antelope. They come from the low land south of Massaua on the Bay of Adulis. They are called Asorta goats, after the tribe of the Asortas, who raise them. Most of these goats are brown and black, although many are of a reddish brown or brown and white mixed. They are tall, thin and of fine build, intermediate between a sheep and an antelope.

Berlin is the city that has set the good example of constructing handsome buildings in her Zoo, which good example Dresden is following as well as it can with its limited means. A proof of this is the house for "hay-feeders" (Graminivores) with its new decorative finish, which formerly was a simple massive building with only a small relief of giraffes' and antelopes' heads to indicate its purpose. When a thorough repair of the building was necessary, it was given into the hands of the able and artistic decorative architect, Moritz Lehmann of Berlin, who for many years lived and worked in the Orient and who has made quite a name for himself by his works at the exhibition in Cairo. In renovating the house at the Dresden Zoo, it was not possible to make it strictly Turkish, Indian or Arabic, but using oriental *motifs* where such were possible, it still retains its modern style. Two large paintings cover the southwest wall; one an antelope hunt, the other a herd of zebra and gnus.

There are plenty of animals in the house at present. Among them are a pair of *Equus Chapmani*, three Burchelli zebras from South Africa, an onager or wild donkey from the west of middle Asia, a pair of dromedaries from North Africa, a pair of white camels from South Russia, three red young stags from Brazil, three Nilgan antelopes from the north of India, at the foot of the Himalaya Mountains, one goat antelope from India, one dorcas antelope from Arabia, one sword antelope from India, one marsh antelope from West Africa, a pair of "wasserböcke" from the Senegal, a pair of gnus or wildebeests, and a pair of anoa or antelopes from Celebes.

For our engravings and the accompanying description we are indebted to Illustrirte Zeitung.

PLANT COLONISTS.

MR. R. LLOYD PRAEGER writes as follows in a recent Knowledge on "Plant Colonists": "When our forefathers commenced to till the ground, a destruction of the native plant associations was the result; and this gave an opening for other plants suited to the new conditions. Annuals could maintain their hold year by year on the tilled land, where the former perennial plant-groups could no longer exist. And clearly those plants whose seeds happened to be mixed with the grain which the early husbandmen sowed would have an excellent opportunity of survival. Thus we can conceive that the now large and well-marked group of

weeds of cultivation had a very early origin. Nor is it impossible to conjecture that in some cases plants originally native may have found a congenial habitat in these prepared grounds, and by degrees forsaken their old haunts and established themselves mainly here, and become parasitic, so to speak, not on man, but on man's operations. Certain it is that we have plants in our flora which are presumably original natives yet are always or generally found in association with man (though not of any service to him) in cultivated land or about dwellings, etc. Pot-herbs and simples were no doubt also of very early introduction, and, planted near the dwellings, in many cases established themselves. In the woodlands and thickets, the influence of man was probably more slow to make itself felt; but the lopping of branches and felling of trees of chosen sorts for the manufacture of utensils and implements, and for firewood, must have by degrees effected the plant associations of the forest; and in later times wholesale clearing of wooded areas for purposes of husbandry banished the sylvan species, and allowed other plants to usurp the ground. And all the time, as trade and intercourse increased, circumstances favored the introduction of fresh colonists. The growth of towns began to have a local effect on the flora; accumulations of rubbish of all kinds harbored a motley half-alien vegetation, and the fouling of rivers tended to break up the natural plant associations of the waters. The draining of marsh-lands completely altered the flora of large areas; the building of roads and the diverting of streams played their parts both in extermination and introduction."

THE SIERRA NEVADA.

THE part of the Twenty-first Annual Report of the U. S. Geological Survey devoted to Forest Reserves, by Mr. Henry Gannett, Geographer, now in press, but not yet published, contains the reports on the Yosemite and Sonora quadrangles, by Mr. C. H. Fitch, and on the Markleeville, Pyramid Peak, Placerville, Dardanelles, Big Trees, and Jackson quadrangles, by Mr. George B. Sudworth. The total area included in the examination, over 7,600 square miles, is a famous part of California. It runs from the San Joaquin Valley on the west eastward across the Sierra Nevada into the deserts of Nevada, forming a complete section of the great range of California, and including a part of the great gold belt or Mother Lode, groves of big Sequoia trees, the Yosemite National Park, and nearly the entire areas of the Stanislaus and Lake Tahoe Forest Reserves. The counties of Eldorado, Alpine, Amador, Calaveras, Stanislaus, Tuolumne and Mariposa are included, in whole or in part. The area slopes in a long swell from 500 feet above sea level at the western edge to nearly 14,000 feet near its eastern edge. Up to about 3,000 feet the country is covered with chaparral, with scattered oaks and digger pines. At 3,000 feet yellow and sugar pines appear, and the forest continues to over 8,000 feet, forming a belt 40 to 50 miles wide on the slope of the range.

In the early California days, the placer diggings in the Sonora quadrangle were thronged with miners and their camps. Gold is now sought for there in quartz. These mines and mining towns need supplies. Hence much land, with or without irrigation, is utilized for agriculture and pasturage, though it can hardly be classed as either agricultural or pastoral land. Merced and Tuolumne rivers supply water for irrigation.

The Sonora quadrangle rises from 500 to 3,000 feet above sea level, where the timber belt proper begins.

The Yosemite joins the Sonora quadrangle on the east and rises to 11,000 feet. This quadrangle is nearly all within the Yosemite National Park. Practically there is neither farming nor pasturing on these Park lands.

The timber of commercial value grows best between the altitudes of 4,500 and 6,500 feet. The principal timber trees are yellow pine, sugar pine, and red fir. In some areas the stand of timber will run from 80,000 to 140,000 feet, board measure, per acre; the usual range is from 5,000 to 50,000 feet per acre.

The forest is open, with little underbrush. Three groves of big Sequoia trees are in the Yosemite quadrangle, the Merced, the Tuolumne and the Mariposa. Sequoias of all ages are to be found in the Mariposa grove, many of them thrifty trees measuring from 1 to over 30 feet in diameter, and 300 feet high. Mr. Fitch thinks that, with continued and proper protection against fire, the Sequoias may be able to perpetuate themselves; but that reproduction is not now going on to any extent, and fires are not wholly guarded against. The famous Yosemite Park is illustrated in the nine plates attached to the report. The total stand of timber on these two quadrangles is 11,000,000,000 feet.

Roughly estimated, the territory examined by Mr. Sudworth amounts to 5,116 square miles, or about 3,270,000 acres. As in the Sonora and Yosemite quadrangles, the country slopes up from the San Joaquin Valley, past valleys and canyon bottoms from 5,000 to 7,000 feet above sea level, on to peaks that rise from 9,000 to 10,400 feet high, and it incloses in its high ranges a few large and many small subalpine lakes. Deep river canyons traverse the country carrying waters of the Rubicon, the American, the Cosumnes, the Mokelumne, the Calaveras, and the Stanislaus rivers. Mr. Sudworth names some seventeen principal towns of the region whose permanence depends on the mining interests. Gold mining is the principal industry, though there is some grazing, agriculture and lumbering.

Seventy-five or eighty per cent of this region is is more or less wooded. A narrow belt of thinly stocked woodland oaks and digger pines runs up to about 2,000 feet; a broader belt of open timber forest of yellow pine, incense cedar, red fir, and sugar pine extends up to 6,000 feet; a third belt of lodge-pole pine, black hemlock, California red fir, and white bark pine, runs up to the timber line at about 9,500 feet. The commercial timber is found mainly in the middle belt, and consists chiefly of yellow and sugar pines. Here the stand of timber ranges from 2,000 feet up to 50,000 feet per acre. The total amount of timber estimated upon these quadrangles, including the two forest reserves, is nearly fourteen and a half billion feet, board measure.

Fires have prevailed in this territory since a very early period, and they are still frequent, widespread and destructive.

With regard to the Sequoias, Mr. Sudworth states that they grow on the west side of the Sierra at from 4,600 to 8,400 feet above sea level. Eleven isolated groves are found which extend about 260 miles southward from the southern border of Placer County. Two of these groves, the Calaveras and the Stanislaus, or "South Calaveras," are included in the territory under consideration. The trunk of the big tree has an enormous swell at the ground. This swell is from 2 to 8 feet greater than the diameter at 6 feet from the ground. The length of clear stem varies from 100 to 180 feet. The trees in the Calaveras grove range from 9 to 19.5 feet in diameter 6 feet above the ground, and from 235 to 325 feet in height. There is no reproduction of the big trees in the Calaveras grove, and the reproduction is found at only two points in the Stanislaus forest, where fallen timber has protected them. The seedlings are from 2 inches to 4 feet high, and the saplings are from 10 to 30 feet high. The stump of a Calaveras tree, cut down in 1853, measured 27 feet inside the bark, and the age of the tree is estimated as about 1,300 years. Mr. John Muir states that a tree of similar diameter cut down in Kings River grove was 2,200 years old. He mentions another tree of the same grove as being 4,000 years old, and probably older, as all the rings could not be clearly counted. Probably none of the Calaveras or Stanislaus grove trees are older than this, and most likely the majority are under 2,500 years.

Thirty plates illustrate the classification of the lands, the trees, lakes, canyons, etc., of the region. There are presented also as part of this general report a number of land classification maps made by various persons and representing the distribution of the surface into wooded, pasture, and cultivated lands, in various quadrangles in California, Oregon, Washington, Idaho, Wyoming and Alaska. The woodlands of Indian Territory have also been accurately mapped, and the reports of the subdivision surveyors have been compiled and prefaced by Mr. C. H. Fitch, and they are presented with a map and summary of the forest conditions of this region. The scattered information containing the rate of the growth of forest trees has also been collated in tabular form and discussed by Mr. Gannett.

MOUNT RAINIER.

THE examination of the Mount Rainier Forest Reserve, Washington, together with the Mount Rainier National Park, Washington, by Mr. Fred. G. Plummer, forms part of the report on Forest Reserves, by Mr. Henry Gannett, geographer, in the twenty-first annual report of the United States Geological Survey, now passing through the press, but not yet published.

The Mount Rainier Forest Reserve includes the crest of the Cascade Range, in Southern Washington, with its slopes upon the east and the west. Of the total of 2,146,600 acres, 41.4 per cent. lies on the eastern slope, and 58.6 per cent. on the western slope of the mountains. All of the eastern slope and most of the western slope, 83.6 per cent of the Reserve, are drained by thirteen rivers into Columbia River; the remainder is drained by three rivers into Puget Sound. The reserve includes the great volcanic peak of Mount Rainier, 14,526 feet; Mount Adams, another great volcanic cone, 12,470 feet; Goat Mountain, 8,500 feet; and Mount Aix, 7,623 feet. From these heights the land sinks down to within a few hundred feet of sea level. The bold topography of the reserve is the cause of wide diversities in climatic conditions. The rain-bearing clouds, borne on southwest winds, pass easily through breaks in the Coast Range to the heights and valleys of the Cascade Range. Hence the strong contrast between the corn and tobacco fields of the Cowlitz Valley and the 32,500 acres of glaciers and perpetual snow fields of Mount Rainier. Only about 45,000 acres, or 2 per cent. of the entire reserve, are fair farming land, and more than one-half of this is too high or too much exposed.

The Davis Coal prospect on Summit Creek claims a vein 6 feet wide; and several other coal veins have been prospected. The principal mining for metals is the Summit district just east of Mount Rainier; many claims have been taken up; none were productive at the time of the examination. A number of mineral springs, chiefly soda and iron, are found. All the divides become beautiful parks plentifully grassed and flowered as they approach the slopes of Mount Rainier; and at least 80 per cent of the areas above 5,000 feet and below the timber line may be classed as mountain meadows.

This region, in respect to its forest cover, is sharply divided into two parts by the crest of the range. Upon the west the forest is that of the Pacific Coast, with very dense undergrowth. It is very heavy up to altitudes of between 3,000 and 4,000 feet, where it begins to thin, and above 6,000 feet it is almost entirely wanting. The forest is composed, in the main, of red fir, with some spruce, hemlock, and cedar. It is heaviest in the valleys and upon the north slopes of the ridges, rather than upon the south slopes. East of the crest of the range the forest is comparatively light and open, with little underbrush, and is composed almost entirely of yellow pine. Mr. Plummer notes that owing to the bold topography of the reserve, and the presence of numerous perpetual snow fields and glaciers, there is no altitude which may be termed a timber limit. Thus upon Mount Rainier the Alpine trees reach an extreme limit of about 7,600 feet, but at Goat Peak the same forms are found at an elevation of 8,400 feet.

The entire stand of timber upon the reserve, including the park, is estimated by Mr. Plummer at 20,013,285,000 feet, B. M., an average per acre of 9,323 feet board measure. Of the total amount, 42 per cent is red or yellow fir, 17 per cent hemlock, 10 per cent yellow pine, and 6 per cent each red cedar and noble fir, the remainder being made up of a variety of species.

Mr. Plummer calls attention to the value of the humus in retarding surface drainage. On the eastern slope, in the watershed of the Yakima River, the surface flow continues to feed the river for three months after winter rains and snows are over. This is of immense importance in irrigation, it being estimated that a fall of one foot in this river affects 300,000 acres of land.

Fire has been very destructive in this region. Upon the west slope restocking after fires commonly takes place promptly by the same species; but upon the drier east slope restocking is much slower. Fires are started by sheep men, prospectors, settlers, Indians and camping parties. Lightning also starts fires occasionally.

There is little or no cutting of timber in this region. Large numbers of sheep are herded on the 800,000 acres of grazing lands of the reserve, mainly on the eastern slope of the Cascade Mountains.

Mr. Plummer says that the scenery of the reserve is on too grand a scale to be affected by any operations of man, such as grazing and herding, but that it is disfigured by the fires.

Eighteen plates, including some beautiful views, illustrate the report.

THE CASCADE RANGE.

THE report of the examination of the "Cascade Range and Ashland Forest Reserves and Adjacent Regions," by Mr. J. B. Leiberg, now in press, but not published, is a part of the Twenty-first Annual Report of the United States Geological Survey, and is edited by Mr. Henry Gannett, Geographer. The region discussed in this report is in southern Oregon. It contains nearly 8,000 square miles, 4,676,360 acres, comprising the central and upper areas of Rogue and Klamath River basins, and a small part of the watershed of the upper South Umpqua River, and is divided into two nearly equal portions by the main range of the Cascades. The eastern and western slopes have many dissimilar characteristics, the country dropping down on the west in long spurs to the valley of Rogue River, and on the east in steeper declivities to the Klamath Lakes and the great plains stretching eastward from them. The mean elevation is 6,000 feet. The character of the Cascade Range is volcanic, the cones and peaks being of different ages, and extinct craters abounding among them, the one containing the famous Crater Lake. The Ashland Forest Reserve consists of Siskiyou Peak, or Ashland Butte, nearly 8,000 feet above sea-level, and contains over 22,000 acres. The object of this reserve is to maintain the volume and purity of Ashland Creek, the water supply of the town of Ashland. The Siskiyou Mountain range forms a connecting link between the Coast Range and the Cascades.

In this region the same general conditions prevail as in the Mount Rainier Reserve. The crest of the range forms a dividing line between two widely differing sets of forest conditions. Upon the west, with an ample rainfall, the forests are fairly dense, and the undergrowth luxuriant. Upon the east, where more arid conditions prevail, the forests are open, with no underbrush. The species differ measurably on the two sides. Those on the west side consist largely, if not mainly, of red fir, while upon the east side the forest is largely of yellow pine. Of the area examined by Mr. Leiberg 65 per cent is forested and 35 per cent not forested, the non-forested areas lying mainly in the extreme west and in the eastern part of the area examined. The amount of sawmill timber found upon the forested area is estimated by him as a little less than twenty thousand million feet, an average per acre of the forest land of 6,660 feet. Of the total stand of timber upon this area, yellow pine comprises 48 per cent; red fir, 33 per cent; white fir, 6 per cent; noble fir and sugar pine, each 4 per cent; and the remainder is of other species. West of the Cascade Range, red fir is the dominant species, affording more than half of the total amount of timber, yellow pine being next with nearly one-fourth of the total; east of the Cascades, on the other hand, yellow pine constitutes six-sevenths of all the timber.

Fires have widely ravaged this region. Of the forested area examined, in round numbers 3,000,000 acres, Mr. Leiberg estimates that 2,975,000 acres, or 99.99 per cent, are fire marked; and that of this fire-marked area, 587,000 acres are badly burned. That is to say, within the last forty years, settlement clearings not included, 7,000,000,000 feet, board measure, of merchantable mill timber has been destroyed by fire.

This paper is well illustrated by fourteen plates.

OLYMPIC FOREST RESERVE.

THE description, from field notes, by Messrs. Arthur Dodwell and T. F. Rixon, of the Olympic Forest Reserve, Washington, is a part of the report on Forest Reserves, by Mr. Henry Gannett, Geographer, now in press, but not yet published, which constitutes Part V. of the Twenty-first Annual Report of the United States Geological Survey. The reserve comprises an area of 3,030 square miles, or 1,939,200 acres, and includes parts of Clallam, Jefferson, Chehalis, and Mason counties. The reserve consists of the Olympic Mountains, which rise to summits exceeding 8,000 feet in altitude, and their slopes upon all sides. Upon the east it extends nearly to Puget Sound, upon the north to the Strait of Juan de Fuca, and upon the west nearly to the Pacific Ocean. Eleven rivers drain its territory. The rainfall of this region is probably the heaviest in the United States, the Alaskan Coast excepted. It has only about 4,000 acres now ready for use as agricultural land. Large areas of unused grazing land, about 64,000 acres in all, are found upon the tops of the ridges, between an elevation of 4,000 and 6,000 feet. Mining operations are being pushed along the north watershed of the Elwha River, but, though gold and copper have been found, the formation does not warrant the belief that any paying mine will ever be located upon this portion of the reserve. Logging operations have not been found practicable because the rivers are too swift and subject to too many freshets. The Indians have to pole their canoes up these streams when trapping and fishing, as rowing is impossible; furthermore, there are no harbors on the Pacific Coast of the reserve. There are no railroads in the reserve at present, but a railroad around the coast with spurs up the valleys would reach nearly all the timber on the west slope.

The lower country up to altitude of fully 3,000 feet is heavily timbered. The total stand of timber upon the area examined is 37,100 million feet, an average per acre for the entire area of 21,000 feet. This is the

most heavily timbered part of the State. This enormous body of timber consists of hemlock, 42 per cent; red fir, 26 per cent; silver fir, 15 per cent; cedar, 10 per cent, and spruce, 7 per cent. Fires have been extensive and severe, and, in spite of heavy rainfall, restocking of the burned areas has made little progress. The report is illustrated by twenty plates.

TRADE SUGGESTIONS FROM UNITED STATES CONSULS.

Manufacture of Paper in Formosa.—The Formosan Government is giving the local production of paper some attention, and a model hand paper factory is in course of construction near Kagi. The manufacturers of paper machinery in America may find the following of interest, and if there are machines which can handle the Formosan raw material and prove economical as compared with the hand process, there is an opening for such machinery in this island.

The manufacture of paper in Formosa has been an industry of considerable importance for some years. A small bamboo found in the Formosan hills is the chief material used; and, as a rule, the industry is carried on in the vicinity where this variety of bamboo is most abundant. The method of manufacture is as follows:

The young branchless bamboos are usually cut during the months of May or June, when the plant has attained a height of 4 or 5 feet. The stalks are first crushed with a wooden hammer, then placed in a cemented tank some 5 feet long, 3 feet wide, and 4 feet deep. Water to cover and a quantity of lime are added, and the material is left thus to decompose for about forty-five days. It is then removed, washed with fresh water, and placed in a second pit, similar in size to the above, where it is allowed to soak for a further forty-five days or more. The fibrous matter, now much softened, is placed in a stone mortar, which is used with a stone pestle worked by foot, similar to the Chinese rice-cleaning mortar. Here, the fibrous material is broken up and crushed until it has been reduced to a pulp. It is next placed on a platform and trodden by foot until the water has been partly driven out and the pulp becomes sticky. The pulp is then removed to a third cement vat, which has been previously partly filled with clean water, and is stirred until the mixture has attained the right consistency. The material is now considered ready for the final operation. For this, a screenlike implement is brought into use. This consists of a frame 2 feet 4 inches by 9 inches, supporting brass wires running crosswise and lacquered bamboo strips lengthwise, forming a fine network. A second frame of thin wood fits closely upon the screen, its outside rim being extended slightly to retain the quantity of pulp required for a single sheet. A third frame holds both the above together, and, by its projecting sides, furnishes a grip for the hands during its manipulation.

The complete implement is now dipped in the vat in such a way that the screen becomes covered with the pulp. The implement is lifted out horizontally and shaken a bit to distribute the pulp evenly. Most of the water passes out quickly through the netting, and, the outer frame being removed, the inner frame is placed in an inclined position to drain. When the water ceases to pass off, the screen is inverted, and the soft sheet is allowed to fall out upon a board arranged for that purpose. Thus the operation proceeds, the sheets being placed one on another until the pile is some 3 or 4 inches high. A second board is now superimposed and the lot placed under a long wooden lever near its attached end. By weights placed on the free end of the lever, the sheets are subjected to considerable pressure, which removes the superfluous water and gives compactness and firmness to them. On being released from the press, the sheets are taken out, four at a time, placed in a split bamboo, and hung out in the sun to dry. If the weather is unfavorable, the sheets are kept under cover until there is an opportunity to dry them. As might be expected, this extremely crude process is very wasteful of time, and not infrequently, owing perhaps to unfavorable weather, six months is required before the whole operation is complete. Sizing, glazing, hot pressing, and other methods of improving the grade of paper are unknown to the local Chinese, and the Formosan product is a thick, rough, coarse straw-colored paper, abounding in partly macerated bamboo fibers, which are often so slightly incorporated with the body of the paper that they can be shaken off. The sheets measure 12 by 29 inches, and are sold for 15 sen (7.2 cents) a hundred.

The chief center of this industry is Kagi, and in that city and vicinity many million pounds of the paper are produced annually, valued at some 200,000 yen ($100,000). There is practically no export. As common Chinese paper valued at over 350,000 yen ($175,000) was imported during the year 1899, in spite of a 15 per cent customs impost, it would appear that there is a considerable field open for the further development of the industry. With the water power obtainable in the higher reaches of the Tamsui River and the abundance of raw material, it would appear that a small modern paper mill might also be a profitable venture. The consumption among Chinese of all grades, excluding foreign glazed paper but including the native product, reaches an annual value of over 650,000 yen ($325,000) and appears to be increasing. Raw material is more abundant in the island than in either China or Japan, and it would be quite possible to build up an export trade.

The paper mulberry plant (*Broussonetia papyrifera*, Vent.) is also used in Formosa for the manufacture of paper. There is not a large local demand for this product, but it has been found very useful for paper umbrellas, lanterns, etc. Keibi (Kingboi), North Formosa, a few miles south of Taihoku, is interested in the industry, and the method of manufacture described below is that practiced there.

The bark is obtained from the hills to the east of Chureki (Tionglick) and Shinchiku (Teckcham), North Formosa, where the tree appears to be most abundant. Young trees 4 or 5 years old and those grown in shaded valleys appear to yield the best material. The bark of the whole trunk, from top to bottom, is stripped off, and its rough outer skin is removed by scraping. It is then dried in the sun, separated into strips an inch or so wide, and packed up into small bundles. The paper maker purchases the latter at from 4 to 8 yen ($2 to $4) a picul (133 1-3 pounds), according to quality, cost of transportation, etc. Eight sheets of the paper described below can be obtained from 1 pound of the bark. To prepare the bark for paper making, it is first soaked in cold water for twelve or thirteen hours to clean and soften it. It is then placed in a large iron pan, covered with water, to which is added some 14 pounds of Formosan lime to every 100 pounds of bark, and boiled for twelve hours. This operation removes all gummy matters. (If lime is not used, the bark must be soaked for about a week.) The material is then vigorously washed for two hours to remove the lime, this being usually performed in the shallows of the river, a close picket bamboo fence being erected to prevent the fiber strips floating away. It is next removed to a flat stone, where it receives a strong beating for a half hour or so with two wooden mallets, the workman holding one in each hand. The long fibers readily separate under this treatment. The fibers, now thoroughly softened, are immersed in water, and then, with two knives, are chopped up into very small pieces, some half hour being required for this operation. The small pieces are then deposited in a vat on the river bank, water is added, and the mixture is stirred for fifteen or twenty minutes, which converts it into a thin pulp, requiring no further manipulation.

While the mulberry pulp forms the fibrous material for the paper, a mucilaginous substance must be added, which is obtained from the leaves and small branches of young wikstroemia trees. In preparing the latter, the leaves and twigs are first well bruised with wooden mallets and, after water has been added, are vigorously kneaded by hand. The substance is then transferred to a basket lined with coarse jute cloth, which is fastened over the vat, the gummy liquor straining through the cloth onto the pulp.

In forming the sheet of paper, an appliance consisting of a bamboo frame some 4 feet long by 3½ feet wide, with inner crosspieces, over which is stretched a coarse sheet of jute cloth, is used. A large number of these sieve-like utensils is required, and they are taken, one at a time, to the workman at the vat. Here, the sieve is placed with one side of the frame resting on a post and the near side held by the vatman's left hand. With his right hand, the pulp is ladled out of the vat and poured onto the sieve; the latter is then given a rocking motion until the pulp is spread over it evenly, the surplus water finding its way through the coarse cloth. When the pulp is partly thickened, the frame is removed and set up in an inclined position. If the weather is suitable, the pulp dries quickly, and on a sunny, summer day some four batches can be made, but in winter only three. When dried, the paper is stripped off the frame easily. It is of a pale mouse color, the sheets being some 3 by 3½ feet in size, and is light in weight, resembling in this respect a medium-graded tissue. It is fairly smooth and soft, but, owing to the coarse method of production, contains much half-macerated matter, small pieces of bark, etc. It sells in the local market at from 1 to 1.80 yen (50 to 90 cents) per 100 sheets. It is used in the manufacture of paper umbrellas, Chinese lanterns, and rain coats.

In the manufacture of these articles, the paper is first painted with persimmon liquor, which hardens it and renders it almost impervious to water. Two or more layers glued together are generally used, and the finished product is varnished, giving a strong, waterproof article. For these purposes, the Chinese manufacturer asserts that the local paper is superior to other available papers, either domestic or foreign, not even excluding the uncommonly strong Japanese paper which, owing to its comparatively low cost, is sometimes used.

There are other materials in Formosa suitable for paper manufacture which as yet have not been utilized. The fibrous stalk of the banana plant can be obtained in abundance, and there is also considerable jute refuse which would be available. The small shrub *Wikstroemia indica* grows wild in the hills and plains and is very plentiful on the coral reefs of extreme South Formosa. A beautiful soft paper resembling French tissue has been manufactured in Tokio from this material sent there from Formosa, and it is hoped that further experiments will be conducted to ascertain definitely the practical value of this plant for paper making.

The Formosan Government is inclined to encourage the paper industry, and the model paper factory now in course of construction will be devoted to experimental work in order to ascertain the most desirable methods of hand manufacture. Power appliances might be introduced if they were found to be economical and the first cost were not prohibitive. The object of the government is rather to improve the native methods of manufacture already in existence than to establish a large factory, which would take the industry out of the hands of the many now engaged in it. There is doubtless, however, apparatus (preferably requiring but small power), such as pulp machinery, etc., which could be introduced to advantage.

In Kagi, a small Japanese concern has been organized which will invest 15,000 yen ($7,500) in a handmill. It will start with ten pulp tanks, and it is said that each tank will yield material for 2,600 sheets of "mino" paper daily, which will give the mill a yearly capacity of 800,000 sheets. There is water power available, and it is reported that this company will utilize some simple pulp machines obtained from Japan. There is an abundance of raw material. Paper mulberry is utilized in Japan in the manufacture of "mino" paper, which is a strong, clean colored, unglazed paper of fine texture used by Japanes officials throughout that Empire for correspondence and documents.

I would advise manufacturers of paper machinery suitable for small mills to forward to this consulate catalogues and full information on the subject; and this office will place the same before the persons interested.—James W. Davidson, Consul at Tamsui.

Transportation Facilities for Siam.—In 1898, 88 per cent of the trade of this port was carried on in British bottoms. To-day, there are three boats under the British flag regularly plying between Bangkok and Singapore, and these are owned by British-Chinese firms; another boat, running between Bangkok and Bombay, belongs to a British firm; and the heavy demand for shipping, caused by the unusually large rice crop, has brought two or three transients under the British flag from Hongkong and Swatow.

In 1898, the Norddeutscher Lloyd Company purchased the Holt Line of British boats running between Bangkok and Singapore, and also the Scottish Oriental Line running between Bangkok and Hongkong. The managers have added to these fleets five new ships and transferred from other lines two others, have added two large new steam lighters, have purchased a coastline steamer to serve as a steam lighter, and have on the stocks in Europe two large steamers to be used next year. Besides, they have been obliged to use transient boats to meet the demand of the past eight months. This company now has a steamer leaving Hongkong for Bangkok and Bangkok for Hongkong about every three days, and the same service between this port and Singapore. A great improvement for passenger traffic has been made by the introduction of the steamship "Deli" on the Singapore run. She is a fine boat, fitted up after the manner of our passenger boats on the Sound and the Great Lakes, with accommodations for first and second class passengers, and leaves Singapore every second Thursday in connection with the outward German mail, returning in time for the homeward mail on Monday.

It is estimated that about 80 per cent of the regular trade of this port is now under the German flag.

Activity in the export of rice, due to the excellent crop of last season, has stimulated the shipping of the port and has brought an unusual number of transients into the trade. Unless something unusual occurs, this year's crop will be quite as large.

This activity is also expressed in the demand for lighters. The Bangkok River is closed by a bar and only vessels drawing 11 feet of water can be sure of crossing at all tides, while those drawing 13 feet can cross only at top of spring tides. Most vessels, therefore, go outside the bar to complete their loading at the Island of Koh-Si-Chang or at Anghin, on the mainland, a distance of some 20 miles from the river mouth or 45 from the city. The cargoes are brought down by lighters. The demand this year has been so large that although everything available in the way of sailing or steam craft has been requisitioned, the number has proven quite inadequate to handle the traffic and the dispatch of cargoes has been seriously hindered.

It is impossible to send goods from America to Bangkok without at least one transshipment. Every facility for the through shipment of goods is furnished the British, German, French, Danish, and Russian markets, and there are local houses here to look after the interests of all these countries.

It cannot be expected that American ships will ply between Bangkok and New York in the immediate future; but much might be done toward improving facilities for shipping goods both ways, by through bills of lading, if there were established here an American firm representing American trade whose business demanded these facilities. Such arrangements can now be made here, but the men intrusted with this matter are largely engaged in conflicting interests.

Duties are fixed by treaty at 3 per cent on all imports except liquors, on which the rate ranges from 5 to 10 per cent. The cost of freight from New York to Bangkok is from $9 to $12 gold per ton.

All goods coming to this port must be transshipped at Singapore or Hongkong, as there is no through line of steamers from America or Europe to Bangkok, except the East Asiatic Company, which operates a line of fine boats between Copenhagen and the Far East. These are booked to touch at Bangkok on their way home, every three months.

As I write (November 30) there lies before me a good-sized invoice of American goods for Bangkok that were shipped from San Francisco by way of Hongkong. This invoice bears the date of May 15, 1901, and the importer is here to-day to inquire if we can help him to trace his goods. This is by no means an isolated case. Certain American goods lay in the warehouses at Singapore over five months this year. This ought to be remedied in the interests of the trade.

With the direct lines of boats now running between New York and Singapore en route to Manila, and between the Pacific coast and Hongkong, a little intelligent effort on the part of those interested ought to lead to such arrangements as would insure against delays at these ports of transshipment. It is also believed that better freight rates could be arranged.—Hamilton King, Consul-General at Bangkok.

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The Reports marked with an asterisk (*) will be published in the SCIENTIFIC AMERICAN SUPPLEMENT. Interested parties can obtain the other Reports by application to Bureau of Foreign Commerce, Department of State, Washington, D. C., and we suggest immediate application before the supply is exhausted.

TRADE NOTES AND RECEIPTS.

Acetylene Black.—By Jos. Dépierre in the annual report of the Industrial Society of Muelhausen. Among the various new products exhibited at the Paris Exposition of 1900, acetylene black deserves much attention. In textile printing black powders are often used for the production of black or gray shades. The requirements demanded of these black pigments are as follows. They must be readily miscible and stirrable with water, must yield handsome and uniform "unis" (solids) and be of a faultless, uniform nature, so that the buyer is not compelled to test the quality of the preparation with every order. Furthermore, the black powders must be free from extraneous admixtures, not only with reference to the quality of the black shade, but also for the purpose of avoiding irregularities in the printing.

The new black seems to answer all the aforesaid requirements. In its production quite a different process is pursued than the principle governing the manufacture of lamp black, Frankfort black, etc. The process is based upon the ready decomposability of acetylene in its components, carbon and hydrogen, due to its endothermic formation, which may be called forth by even a slight suitable heat of the electric source of energy.

M. Hubon, engineer at Raincy, near Paris, effects the decomposition of acetylene with exclusion of air, under pressure, and thus produces a very finely divided carbon, which he calls acetylene black. The mode of production, which has been found quite satisfactory, is as follows: Acetylene is first compressed in a perfectly exhausted closed vessel to two atmospheres pressure, since it can be readily made to explode at this pressure. The explosion is caused by an electric spark or by a wire made incandescent by electricity. The whole receptacle will be filled after the use with light, most finely divided, voluminous carbon, and the resulting hydrogen may be collected separately for other uses.

Acetylene consists of 92.3 per cent. of carbon and 7.7 per cent. of hydrogen; hence a cubic meter of acetylene yields one kilogramme of acetylene black and one cubic meter of hydrogen. The industrial cost of production of acetylene black has not been established as yet, but it does not seem to exceed 3.20 marks.

Acetylene black contains 99.8 per cent. of pure carbon; it is perfectly uniform and of excellent fineness. In this state it readily mixes with water and with the customary thickening agents, such as mucilage, glue, etc.

A printed calico sample attached to the report is produced with albumen water; the color contains 50 grammes of black per liter. Likewise, acetylene black may be mixed with all the plastic colors used in textile printing, such as ultramarine, Guignet green, etc., and they may be used for printing on it. We are of the opinion that there is quite a future in store for this product, not only in the manufacture of sleeve linings, but as an excellent albumen black generally.—Farben Zeitung.

Colored Hygroscopes.—Hygroscopes are instruments serving to indicate the degree of humidity of the atmosphere in which they are placed. The cat-gut is generally at the bottom of the apparatus of current manufacture which effect, by means of a small lever, the displacement of some index such as a monk's hood, lady's umbrella, etc.

Some hygroscopes are not mechanical; they owe their hygroscopic properties to their color, which changes with the state of humidity of the air by reason of the application of sympathetic inks.

These instruments are often composed of a flower or a figure, of light muslin or paper, immersed in one of the following solutions:

Cobalt chloride	1 part
Gelatin	10 parts
Water	100 parts

The normal coloring is pink; this color changes into violet in medium humid weather and into blue in very dry weather.

Cupric chloride	1 part
Gelatin	10 parts
Water	100 parts

The color is yellow in dry weather.

Cobalt chloride	1 part
Gelatin	20 parts
Nickel oxide	75 parts
Cupric chloride	25 parts
Water	200 parts

The color is green in dry weather.—Revue Chronométrique.

Spirit Varnishes.—White Straw-hat Varnish, Extra Fine.—Sandarac, select, 1 part; refined rosin 3 parts; Manila copal, spirit-soluble, 4 parts; Venice turpentine, 1 part; linoleic acid or castor oil, 0.5 part; French turpentine oil, 0.8 part; spirit (96 per cent), 13 parts. For brown straw-hat varnish substitute ruby shellac for the sandarac and ordinary colophony for the refined rosin.

White Straw-hat Varnish, Fine.—Refined rosin, 4 parts; Manila copal, 4 parts; Venice turpentine, 0.5 part; linoleic acid or castor oil, 0.2 part; French turpentine oil, 0.8 part; spirit (96 per cent), 12 parts.

White Straw-hat Varnish, Inferior.—Refined rosin, 5 parts; Manila copal, spirit-soluble, 6 parts; French oil of turpentine, 2 parts; spirit (96 per cent), 13 parts. For brown straw hat varnish the place of the refined rosin may be taken by ordinary colophony and ordinary copal.

Varnish for Labels and Drawings, First Quality.—Sandarac, select, 2 parts; Manila copal, spirit-soluble, 1.5 part; French oil of turpentine, 0.6 part; Venice turpentine, 0.5 part; castor oil, 0.1 part; alcohol, 6 parts.

Varnish for Labels and Drawings, Second Quality.—Refined rosin, 1.2 parts; Manila copal, spirit soluble, 2 parts; sandarac, select, 0.8 part; Venice turpentine, 0.4 part; castor oil, 0.1 part; French oil of turpentine, 0.7 part; spirit, 5 parts.

Floor Gloss Oil.—Shellac, A C leaf, 1.2 part; sandarac, 0.8 part; Manila copal, 2.0 parts; rosin, 0.5 part; castor or linoleic acid or wood oil acid, 0.150 part; spirit (96 per cent), 6.5 parts.—Farben Zeitung.

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